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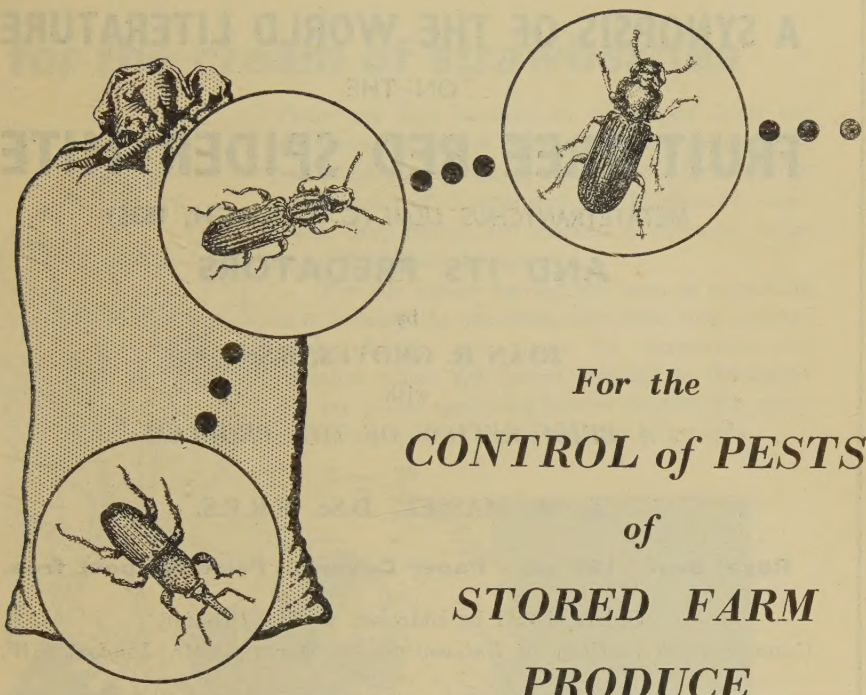

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Stokes (B.). **Behaviour as a Means of Identifying two closely-allied Species of Gall Midges.**—*Brit. J. Anim. Behav.* **3** no. 4 pp. 154–157, 1 pl., 12 refs. London, 1955.

The following is based on the author's summary. In laboratory experiments, *Dasyneura violae* (F. Lw.) and *D. affinis* (Kieff.), although morphologically identical and varying within the same range in number of antennal segments, were found to be quite distinct in their food-plant ranges within the genus *Viola*. *D. violae*, reared from galls on *V. arvensis*, successfully bred on *V. tricolor* and its variety *hortensis*, but would not breed on *V. odorata*, whereas *D. affinis* bred on purple and white varieties of *V. odorata* [*cf. R.A.E.*, A **43** 19] but not on *V. tricolor* or its varieties *nigra* and *hortensis* or on *V. arvensis*. Records in the literature of the two Cecidomyiids on other species of *Viola* require confirmation.

Braun (H.) & Riehm (E.). **Krankheiten und Schädlinge der Kulturpflanzen und ihre Bekämpfung.** [Diseases and Pests of Crops and their Control.]—8th revd. edn., 9½ × 6½ ins., [7+] 368 pp., 346 figs., refs. Berlin, P. Parey, 1957. Price *DM.* 29.80.

This eighth edition of a handbook on pests and diseases of field crops, fruits and vegetables in Germany resembles the seventh in general arrangement of the matter [*cf. R.A.E.*, A **41** 228]. A few additional pests are included, a brief section on virus diseases of fruits has been added, and the number of illustrations has been increased.

Bazzi (B.), de Pietri-Tonelli (P.) & Santi (R.). **Metodi per il microdosaggio chimico e biologico dei residui della N-monometilammide dell' acido O,O-dimetilditiofosforilacetico nell'olio d'oliva.** [Microchemical and Microbioassay Methods for the Determination of Residues of O,O-Dimethyl S-(Methylcarbamyl)methyl Phosphorodithioate in Olive Oil.]—22 pp., 19 figs., 21 refs. Montecatini, Soc. gen. Industr. miner. chim., 1956. (With Summaries in French, English and German.)

The authors describe two colorimetric methods of determining residues of O,O-dimethyl S-(methylcarbamyl)methyl phosphorodithioate in extracts from the oil of olives sprayed against *Dacus oleae* (Gmel.) [*cf. R.A.E.*, A **45** 241], and also a method of bioassay in which adults of *Drosophila melanogaster* Mg. are exposed to dried deposits of the extracts. The limits of accuracy are about 0·5 part per million for the first two and about 0·05 p.p.m. for the last.

Santi (R.) & Bazzi (B.). **Determinazione di residui di N-monometilammide dell'acido O,O-dimetilditiofosforilacetico in ciliege trattate con prodotti a base di tale insetticida.** [The Determination of Residues of O,O-Dimethyl S-(Methylcarbamyl)methyl Phosphorodithioate in Cherries treated with Products containing this Insecticide.]—*Chimica* (N.S.) **12** no. 8 pp. 325–328, 4 figs., 7 refs. Milan, 1956.

Two methods of determining residues of O,O-dimethyl S-(methylcarbamyl)-methyl phosphorodithioate in cherries sprayed with this compound against *Rhagoletis cerasi* (L.) [*cf. R.A.E.*, A **45** 243] are described. One is colorimetric and the other chromatographic, and their limits of accuracy are 0·2 and about 0·6 parts per million, respectively

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Jannone (G.) & Binaghi (G.). **Caso d'infestazione entomatica di fettucce secche di radici di cicoria e impiego di un impianto di fumigazione sotto vuoto.** [An Instance of Insects attacking Pieces of dry Chicory Root, and the Use of a Vacuum Fumigation Installation.]—*Ann. Sper. agr.* (N.S.) **10** no. 6 pp. 2045–2069, 3 pls., 8 figs., 6 refs. Rome, 1956. (With a Summary in English.)

The authors review the development of the use of vacuum fumigation in Italy in recent years and describe the treatment applied to some 4,000 bags of dry chicory root slices imported from Poland in 1952 and found in 1955 to be seriously damaged by insects. The latter were, in order of decreasing abundance, *Stegobium paniceum* (L.) and *Plodia interpunctella* (Hb.), which were together responsible for about 60 per cent. of the damage, *Oryzaephilus surinamensis* (L.), which caused about 20 per cent. of it, and *Tribolium confusum* Duv., *Tenebroides mauritanicus* (L.), *Tenebrio obscurus* F. and *Pyralis farinalis* (L.). After preliminary laboratory tests, fumigation with methyl bromide in a vacuum chamber was selected as the most promising and economical method of control, and the bags were therefore exposed in lots of 30 for one hour to methyl bromide at the rate of about 3·5 lb. per 1,000 cu. ft. in a vacuum of 70 cm. mercury. The treatment killed all stages of the insects present, though some adults of *Tenebroides* and larvae and adults of *Tenebrio* did not die until ten hours after the end of treatment. About half the adults of *Oryzaephilus* survived for up to 20 hours after the end of treatment.

van den Bruel (W. E.) & Bollaerts (D.). **La fumigation à l'hydrogène phosphoré, une technique nouvelle trouvant un large champ d'application.**—*Parasitica* **12** no. 2 pp. 32–56, 3 pls., 3 refs. Gembloux, 1956. (With a Summary in English.)

The Delicia method of fumigating grain and other stored products with phosphine (hydrogen phosphide) [*cf. R.A.E.*, A **33** 230] had several disadvantages, which have been eliminated in the Phostox method. The permeable bags containing the parent preparation are replaced by highly compressed tablets of a mixture of aluminium phosphide and ammonium carbamate, which slowly gives off phosphine, ammonia and carbon dioxide on contact with moisture, the whole being non-inflammable. The residue of aluminium hydroxide that remains at the conclusion of the reaction need not be removed from the treated product. The tablets, which are supplied in airtight containers, can be added to the grain stream during filling operations or inserted into the grain mass to a depth of 10 ft. or more by means of an extensible spear which is described. The treatment may be applied to products stored under all conditions, as it is not necessary for them to be kept airtight during fumigation.

Tests in which the method was used on a commercial scale in Belgium are described. In wheat, sorghum, barley and oats, treatment with about 10–25 gm. phosphine per ton of grain, the concentration varying according to the temperature and conditions of storage, gave complete kill of adults of *Calandra granaria* (L.) and complete or almost complete kill of the larvae; pupae appeared to be more resistant but effective control was obtained in all cases. There was no effect on the germination of malting barley after treatment at five times the normal rate. Complete mortality of all stages of *Trogoderma granarium* Everts in malt was given by treatment at about 12 gm. per ton.

As little was known of the effect of phosphine on mites in stored products, tests were carried out at about 17–25 gm. per ton. Very good results were

obtained against *Tyroglyphus farinae* (Deg.), *Tyrophagus* sp., *Glycyphagus* (*Lepidoglyphus*) *destructor* (Schr.), *Cheyletus eruditus* (Schr.) and *Tarsonemus* sp. in wheat and against *Tyroglyphus farinae*, *Tyrolichus* (*Tyroborus*) *lini* (Oudm.) and *C. eruditus* in flax seed. Hypopi of *Tyroglyphus farinae*, however, were not destroyed. It was noticed that the characteristic odour of grain infested by mites was dispelled by the fumigation, so that samples previously rejected on this account were accepted for milling after treatment. In laboratory tests, smoked ham, cheese and tobacco were not affected by treatment with phosphine even at 4–6 times the normal dosage.

Zangheri (S.). **Un dittero minatore del riso nel Basso Ferrarese** (*Hydrellia griseola* **Fallen, Dipt. Ephydridae**). [*H. griseola* mining in Rice near Ferrara.]—*Boll. Soc. ent. ital.* **86** no. 1–2 pp. 12–16, 9 figs., 4 refs. Genoa, 1956.

Hydrellia griseola (Fall.) was observed attacking rice near Ferrara for the first time about 1950, and observations on its bionomics [*cf. R.A.E.*, A **45** 291] were carried out in the laboratory and field in 1955. Damage, which was considerable, became evident about mid-May, when numerous young plants were killed by the mining of the leaves by the larvae. The adults appeared in early June, and eggs were laid singly or in groups of 2–3 on the upper surfaces of the leaves, though a group of 24 was observed on *Cynodon dactylon* bordering a rice-field. They hatched in 5–6 days, and the larvae entered the leaves, some of them forming several mines in one or more leaves before pupating. The Ephydrid was observed only in May–June, and its habits later in the year are unknown.

Giordani (G.). **Contributo alla conoscenza della** *Senotainia tricuspis* **Meig., dittero sarcofagide, endoparassita dell'ape domestica.** [A Contribution to Knowledge of *S. tricuspis*, an Endoparasite of the Honey Bee.]—*Boll. Ist. Ent. Bologna* **21** pp. 61–84, 11 figs., 44 refs. Bologna, 1956.

The author reviews the literature on myiasis of honey bees and states that the Sarcophagid, *Senotainia tricuspis* (Mg.), has been reared since 1949 from examples collected in various parts of Italy and Sardinia. *S. tricuspis* had previously been recorded as a parasite of bees only from the Ukraine [*cf. R.A.E.*, A **39** 62, etc.], but investigations in France by Simintzis & Fiasson (1950) have shown that *Myiapis angellozi* Séguy [*cf.* **35** 420, etc.] is a synonym of it. *S. tricuspis* is therefore widely distributed in France, particularly in the south. Its world distribution is briefly reviewed, and descriptions are given of the immature stages and the hypopygium of the male, together with an account of observations on its bionomics in Italy. The adult females were observed waiting near the entrances to hives and following the bees as they emerged to forage. They are larviparous and probably deposit a single larva on the body of the host, which it later enters, feeding on the haemolymph. Occasionally two larvae occurred in a single bee. They soon entered the second instar, and remained in it until the natural death of the host, after which they moulted and attacked the thoracic muscles and abdominal organs. When these were exhausted, they left the bee and either pupated or entered other dead bees, in which they fed for a further period. In the latter case, the larval stage was completed in 6–10 days after the death of the original host. Adults emerged in the laboratory in summer after a pupal stage of 16–20 days, though it has been stated that a pupal diapause of 10–11 months is essential. Larvae that pupated after early August did not give rise to adults until the following

year, however, the winter being passed in the soil, so that there is probably one complete and one partial generation a year in Italy. Larvae were observed in bees from June to October, maximum parasitism generally occurring in the second half of July and August. The bees were unaffected by the presence of the larvae and behaved normally in all respects, though the parasite has been considered as injurious.

Monti (L.). **Ricerche etologiche su due coccidi diaspini:** *Diaspis pentagona* **Targ. e** *Mytilococcus ulmi* **L., nella regione romagnola.** [Investigations on the Bionomics of two Coccids, *Pseudaulacaspis pentagona* and *Lepidosaphes ulmi*, in Romagna.]—*Boll. Ist. Ent. Bologna* **21** pp. 141–165, 12 figs., 11 refs. Bologna, 1956.

Outbreaks of *Pseudaulacaspis* (*Diaspis*) *pentagona* (Targ.) have recently occurred in Italy on numerous fruit and ornamental trees, though this Coccid has for many years generally been controlled by natural enemies. Investigations were carried out in 1951–53 on its bionomics in Romagna, particularly on mulberry and peach, which are the trees most heavily infested. Outbreaks on peach may have resulted in part from the destruction of natural enemies by the widespread use of organic insecticides and in part from the decline in the growing of mulberry trees, which are not sprayed and on which populations of natural enemies can develop unhindered. Three overlapping generations were observed each year. The fertilised females overwintered from late October until early April, and the first adults of the succeeding generations were observed about mid-June, mid-August and late September, respectively. Some of the eggs were white, some orange and some intermediate in colour. The last mentioned produced either males or females, and the first two, males and females, respectively. The construction of the scale of the female is described in detail. The more important indigenous or introduced natural enemies of *P. pentagona* are reviewed. Of those observed by the author, the most abundant were the Coccinellid, *Chilocorus bipustulatus* (L.), and the Aphelinid, *Prospaltella berlesei* (How.). A few examples of another Aphelinid, *Azotus chionaspidis* How., were also reared from *Pseudaulacaspis*. This species had not previously been recorded from Europe [*cf. R.A.E.*, A **39** 281]. It is known to parasitise *P. pentagona* in Japan [*cf.* **9** 453] and was probably introduced from that country long ago with other natural enemies of the Coccid.

Investigations were also carried out in 1953 on *Lepidosaphes* (*Mytilococcus*) *ulmi* (L.), which is present in a few localities near Cesena and was studied on poplar at Cesenatico. Damage was not widespread, but 10–15 per cent. of the trees examined were severely stunted as a result of the infestation, which occurs mainly on the woody parts of the trees. The eggs and the scales of the female are described. The overwintering eggs hatched in late April, and there were two generations a year, adults appearing in early June and mid-August, respectively. Males were numerous. The parasites reared from *L. ulmi* comprised *Apterencyrtus microphagus* (Mayr), *Physcus testaceus* Masi, *Aphytis mytilaspidis* (LeB.), *Anabrolepis zetterstedtii* (Westw.), *Azotus chionaspidis* and a species of *Encarsia*, possibly *partenopea* Masi. Only the first three have previously been recorded from *L. ulmi* in Italy.

Antongiovanni (E.). **Impiego del Rogor contro la generazione antofaga della tignola dell'olivo.** [The Use of Rogor against the Flower-infesting Generation of *Prays oleellus*.]—*Olivicoltura* **12** no. 1 repr. 8 pp., 1 ref. Rome, 1957.

In further experiments on the control of *Prays oleellus* (F.) on olive in Italy by means of O,O-dimethyl S-(methylcarbamyl)methyl phosphoro-

dithioate [*cf. R.A.E.*, A **45** 242], three proprietary preparations, Rogor L (a liquid formulation containing 20 per cent. active ingredient), I 382/615 (another containing 10 per cent.) and Rogor P (a dust containing 3 per cent.) were compared with sprays of lead arsenate against the flower-infesting generation [*cf.* **40** 283] near Leghorn. Treatments were applied to groups of three trees on 29th May, just before bud-burst, when many eggs were present but few had hatched. Heavy rain followed three days after treatment. Many buds were open by 6th June, when larvae were observed on untreated trees, and petal-fall was complete by 15th June. Pupation had mostly occurred by 22nd June. Samples of 1,500 buds or flowers from each tree were examined 8–9 days after treatment, and the numbers of living larvae per total of 4,500 were 0–2 for Rogor L at 0·2–0·3 per cent. and I 382/615 at 0·4–0·6 per cent. in normal-volume sprays and 2–3 per cent. and 4–6 per cent., respectively, in low-volume sprays, 0 for Rogor P, and 33 and 77 for lead arsenate at 0·5 and 5 per cent. in normal- and low-volume sprays, respectively, as compared with 112 for no treatment. Small larvae were found dead in some of the buds, though not in those left untreated or sprayed with lead arsenate. Further examination on 15th June showed that about one third of the flowers on trees left untreated or sprayed with lead arsenate were infested, while infestation was only sporadic on the other treated trees. On 4th July, 8–21·7 per cent. of the olives on trees treated with the phosphorodithioate contained eggs of the next generation, as compared with 55·7–66 for the remaining trees, and the percentage was highest on trees nearest to those left untreated or sprayed with lead arsenate. Between 7th July and 13th August, an average of 50·1 per cent. of the olives had fallen from trees in the last two classes, as compared with 26·1 per cent. for treatment with Rogor L or Rogor P; many of the olives fell from causes other than attack by *P. oleellus*. On 13th August, the percentages of olives that contained living larvae were 12·4 for lead arsenate or no treatment, and 2 for Rogor L or Rogor P. The percentages that fell between 13th August and 11th October were 13·1 and 2·8, respectively.

de Pietri-Tonelli (P.) & Barontini (A.). **Esperimenti sull'attività antidacica della N-monometilammide dell'acido O,O-dimetilditiofosforilacetico (L 395), del parathion e della miscela di questi insetticidi con solfato di rame.** [Experiments on the Action against *Dacus oleae* of O,O-Dimethyl S-(Methylcarbamyl)methyl Phosphorodithioate (L 395), Parathion and a Mixture of these Insecticides with Copper Sulphate.]—*Olivicoltura* **12** no. 2 repr. 8 pp., 10 refs. Rome, 1957. (With a Summary in English.)

The results are given of laboratory experiments in which L 395 (O,O-dimethyl S-(methylcarbamyl)methyl phosphorodithioate) and parathion were compared for their action on the larvae of *Dacus oleae* (Gmel.) in olives [*cf. R.A.E.*, A **45** 241]. Sprays were applied at various concentrations, and mortality counts made for up to 13 days. The maximum mortality percentages and (in brackets) the number of days required for them to be attained were 55 (13), 93 (13), 100 (9) and 100 (4) for L 395 at 0·0003, 0·0006, 0·001 and 0·005 per cent., respectively, the amounts of insecticide deposited on the olives being 0·06, 0·1, 0·15 and 0·92 mg. per kg., respectively. The corresponding figures were 92 (13) and 100 (13) for 0·03 and 0·06 per cent. parathion, the deposits being 6·8 and 10·1 mg. per kg. Mortality for no treatment was 4 per cent. in 13 days. When larvae in the early instars only were considered, mortality was complete in 13, 9, 7 and 2 days for L 395 at the four concentrations, respectively, and 88 and 100 per cent. in 13 days for parathion at 0·03 and 0·06 per cent.

In view of the favourable results reported when parathion was applied at reduced rates together with a copper fungicide [*cf.* **45** 132], copper sulphate was added at 0·01 or 0·001 per cent. to L 395 at 0·0003 per cent., at 0·001 per cent. to L 395 at 0·0006 per cent., at 0·1 or 1 per cent. to parathion at 0·03 per cent. and at 0·1 per cent. to parathion at 0·06 per cent. In no case was there any significant increase in mortality.

Aiazzi-Mancini (M.). **Le attuali conoscenze in materia di tossicologia degli esteri fosforici e sul loro impiego nella lotta contro la mosca delle olive (*Dacus oleae*, Gmel.).** [The present State of Knowledge on the Subject of the Toxicology of Phosphoric Esters and their Use against *D. oleae*.] —*Notiz. Mal. Piante* no. 37–38 (N.S. no. 16–17) pp. 51–61. Pavia, 1956.

After a brief discussion of the development of phosphorus insecticides, notably parathion, and of the dangers to warm-blooded animals inherent in their use, the author describes the symptoms of parathion poisoning and the precautions that should be taken to avoid it, and reviews from the literature the results obtained in experiments in which parathion was administered to animals in the laboratory [*cf. R.A.E.*, A **41** 135; **44** 138]. He himself consumed daily, for over two months, 30 cc. olive oil containing 25 parts parathion per million, with no changes in esterase activity. Although oil from olives sprayed with parathion against *Dacus oleae* (Gmel.) in Italy formerly contained residues of up to 24·9 p.p.m. [*cf.* **44** 138], improvements have been made in methods of application and the residues in five samples of olives picked in January 1956 in no case exceeded 3 p.p.m., a level that is considered harmless.

Foresti (B.). **Alcune osservazioni sulla determinazione e sul significato dei residui di paratione negli olii.** [Some Observations on the Determination and Significance of Residues of Parathion in Olive Oil.]—*Notiz. Mal. Piante* no. 37–38 (N.S. no. 16–17) pp. 63–69, refs. Pavia, 1956.

The author points out that the determination by chemical methods of the residues in oil from olives that have been treated with parathion against *Dacus oleae* (Gmel.) is not an accurate indication of their toxicity, since this varies greatly with the degree of chemical change undergone in the olives and with the content of impurities in the original parathion product. Bioassay with insects is time-consuming, and he suggests, therefore, that toxicity be expressed in biological units of anticholinesterase activity measured *in vitro*.

Costantino (G.). **La lotta contro le cocciniglie degli agrumi mediante emulsioni di olii minerali e di esteri fosforici, da sole o in miscele. (Risultati di prove sperimentali.)** [The Control of Coccids on *Citrus* with Emulsions of mineral Oil and phosphoric Esters, alone or in Mixtures. (The Results of Experiments.)]—*Notiz. Mal. Piante* no. 37–38 (N.S. no. 16–17) pp. 91–123, 1 fldg. table, 62 refs. Pavia, 1956.

Fumigation of *Citrus* with hydrogen cyanide against Coccids is obligatory in southern Italy except in certain cases or against species, such as *Planococcus* (*Pseudococcus*) *citri* (Risso), against which it is not effective. Of the other measures permitted, the most usual is spraying with oil emulsion, but

this involves some risk of damage to the trees. Experiments on the control of Coccids with organic insecticides, particularly parathion, are reviewed from the literature, and the results are given of tests carried out in 1951–54 on the comparative effectiveness of reduced concentrations of oil and parathion, alone or together, against *Chrysomphalus dictyospermi* (Morg.), *Saissetia* (*Coccus*) *oleae* (Bern.) and *Lepidosaphes* (*Mytilococcus*) *beckii* (Newm.). The control percentages (calculated after allowing for natural mortality) were 98·24, 96·52 and 97·79 for the three species, respectively, 25 days after treatment with 2 per cent. of a product containing 85 per cent. light mineral oil, 100 and 99·58–100 for *C. dictyospermi* and *S. oleae*, respectively, 18–30 days after treatment with various commercial oil emulsions at 2 per cent., 99·3, 99·62–100 and 100 for *S. oleae*, *C. dictyospermi* and *L. beckii*, respectively, 30–31 days after treatment with a mixture of 1 per cent. oil and 0·02 per cent. parathion, and 98·52–98·93 and 100 for *S. oleae* and *C. dictyospermi*, respectively, 30 days after treatment with parathion alone at 0·02–0·1 per cent. in emulsion sprays. In a further test, mortality was complete for *C. dictyospermi* on both branches and fruit and 98·75–99·41 and 100 per cent. for *S. oleae* on branches and fruit, respectively, 30 days after treatment with parathion alone or combined with oil. When a commercial product containing 80 per cent. light mineral oil and 3·5 per cent. parathion was applied to orange at 1 and 1·5 per cent., the control percentages after 30 days were 99·87 and 99·81, respectively for *Chrysomphalus*, 98·96 and 99·04 for *Lepidosaphes* and 99·34 and 99·51 for *Saissetia*.

It is concluded that any of these treatments is satisfactory, and a schedule for timing sprays against various species of Coccids is suggested, based on their bionomics, observations on which are summarised in a table, and the growth of the trees.

Monastero (S.). **I recenti progressi nella lotta contro la formica argentina (*Iridomyrmex humilis* Mayer.), con particolare riguardo all'uso dei prodotti organici di sintesi.** [Recent Progress in the Control of the Argentine Ant (*I. humilis*), with particular Reference to the Use of synthetic organic Products.]—*Notiz. Mal. Piante* no. 37–38 (N.S. no. 16–17) pp. 125–148, 50 refs. Pavia, 1956.

Iridomyrmex humilis (Mayr) was observed in Sicily for the first time in 1936, when a few orchards and houses to the north-west of Palermo were found to be infested. By 1955, the ant was present along the coast, where vegetable crops and fruit trees are grown, from Cefalù (some 45 miles east of Palermo) to Partinico, though it had not penetrated inland. Infestation also spread to the Province of Messina in 1940 and to Trapani in 1950–52.

The worker ants are active throughout the year, but sexual forms are present only in June–July. The nests are either permanent, such as those built in houses or trees, where the ants can be found both in summer and winter, or temporary and constructed in sites such as open ground in summer and manure heaps in winter. Other ants have largely disappeared from infested areas, though they are still abundant in those not yet invaded [*cf. R.A.E.*, A **37** 58], but *Kalotermes* (*Calotermes*) *flavicollis* (F.) nesting in the same tree was apparently not affected.

The various types of direct and indirect damage caused by the ants are reviewed, with particular reference to the way in which they hinder the natural enemies of injurious Coccids, and a brief account is given of the control measures adopted in Sicily since 1937. These consisted at first largely of the use of baits and traps and of various dusts. In view of the good results obtained in 1948 in north-western Italy with DDT against *I. humilis* [*cf.* **44** 365], tests with organic insecticides were begun near

Palermo. Poor results were obtained with DDT, but chlordane sprays proved very effective, one treatment with 0·5 per cent. of a 50 per cent. product being sufficient to control infestation for at least 45 days. The author considers that *I. humilis* might ultimately be eradicated from the island by this means.

Cavalloro (R.). **Sur un nouveau collembole nuisible au tabac dans les semis** *Seira ferrarii* **Parona.**—*Actes Ier Congr. sci. int. Tabac 1955* repr. [12] pp., 10 figs., 47 refs. Paris [1956]. **Su un nuovo collembolo dannoso al tabacco in semenzaio:** *Seira ferrarii* **Parona.**—*Tabacco* **60** no. 679 pp. 147–166, 10 figs., 47 refs. Rome, 1956. (With Summaries in English.)

In these papers, of which the second is an Italian version of the first, the author reviews the Collembola that attack tobacco in seed-beds and states that *Seira ferrarii* Parona, which had not previously been recorded as doing so, was observed damaging seedlings growing in hot-beds near Salerno in March 1954. The adult is described. In experiments, good control was given by sprays of 0·5 per cent. of a nicotine extract, 0·1 per cent. nicotine sulphate or 0·1 per cent. DDT.

Gallo (F.). *Tyrolichus casei* (**Ouds.**) **nuovo parassita delle tèrmiti.** [*T. casei*, a new Parasite of Termites.]—*Boll. Ist. Pat. Libro* **14** fasc. 1–2 pp. 134–142, 2 pls., 13 refs. Rome, 1955.

The author reviews records of mites attacking termites, and states that examples identified as *Tyrolichus casei* (Oudm.) were found attacking laboratory colonies of *Kalotermes* (*Calotermes*) *flavicollis* (F.) in Italy in 1955. The mites attached themselves to the termites, mostly to the head and legs, and sucked the body fluids from them; both nymphs and adults fed in this way. The termites died within 24 hours, but the mites continued to feed until the body was completely emptied. In observations, fresh termites were supplied daily for about four months, and both *K. flavicollis* and *Reticulitermes flavipes* (Koll.) were always rapidly killed by the mites, even when the latter were relatively few. From the manner in which the termites died, it is thought probable that the mites inject some substance into them that affects the nervous system.

Hurpin (B.). **Influence de la température et de l'humidité du sol sur le développement embryonnaire du hanneton commun** (*Melolontha melolontha* **L.**).—*Rev. Path. vég.* **35** fasc. 2 pp. 75–92, 6 figs., 17 refs. Paris, 1956.

Since the eggs of *Melolontha melolontha* (L.) are known to be sensitive to drought in nature, the influence of soil temperature and humidity on hatching was studied in the laboratory in France. In most of the tests, eggs less than 48 hours old were used. Modifications that take place in the shell during the incubation period are described, and it is shown that there is a fivefold increase in volume and a threefold increase in weight of the eggs due to absorption of water through the chorion; mineral or organic materials were not absorbed.

When eggs were kept in small closed aluminium boxes containing garden soil with a moisture content of about 12 per cent., the percentages that hatched at constant temperatures of 6, 11, 15, 20, 25 and 34°C. [42·8, 51·8, 59, 68, 77 and 93·2°F.] were 0, 4, 65, 62, 19 and 0, respectively, the

incubation period lasting for averages of 150, 55, 32 and 13 days at 11, 15, 20 and 25°C. When the temperatures were alternated for periods of 24 hours between 6 and 15, 6 and 20, 11 and 20, or 11 and 25°C., the numbers of eggs that hatched (out of 120) were 32, 16, 28 and 22, respectively, the incubation periods averaging 93, 60, 55 and 30 days. The threshold of development thus appeared to be about 10°C. [50°F.] and the upper limit about 30°C. [86°F.], and the unfavourable effects of unusually high or low temperature were clear.

In tests on the influence of soil humidity, eggs were kept in a predominantly sandy soil, of pH 6·8, at 11, 15, 20 and 25°C. and a moisture content of 5, 10, 15 or 20 per cent. The percentages that hatched at the four humidities and (in brackets) the average durations of the egg stage in days were 37 (85), 30 (85), 35 (80) and 0 at 11°C., 42 (55), 80 (58), 39 (56) and 0 at 15°C., 47 (28), 79 (23), 84 (23) and 0 at 20°C., and 0, 0, 16 (13) and 0 at 20°C.; the eggs kept at 11 and 20°C. were 12–15 days old at the beginning of the test. When the eggs were kept in a soil of pH 5·5, consisting of 54 per cent. sand, 26 per cent. silt, 17·5 per cent. clay and 2 per cent. organic matter, at the same four temperatures and at moisture contents of 5, 10, 20 or 30 per cent., none of the eggs hatched at 5 or 30 per cent. moisture, and the figures at the four temperatures were 19 (100), 84 (43), 79 (32) and 2 (19) at 10 per cent. moisture and 57 (100), 66 (43), 87 (34) and 6 (19) at 20 per cent.

The two soils used in the humidity tests became saturated at moisture contents of 23 and 30 per cent., respectively, and it is concluded that for the eggs to hatch, the soil must contain between 20 and 75 per cent. of the amount of water necessary for saturation. It is noted that at a relatively low temperature (15°C.), a higher percentage of the eggs hatched at a fairly low soil humidity (10 per cent.), but when the temperature was optimum for hatching, soil humidity was less critical. The process of hatching is briefly described, and it is concluded that unfavourable conditions of temperature and humidity are likely to cause considerable mortality of the eggs; this will be greatest in years in which the summers are dry and hot.

Andrоić (M.). **Contribution à l'étude de** *Cnethocampa pityocampa* **Schiff.** —*Rev. Path. vég.* **35** fasc. 4 pp. 251–262, 1 map, 2 graphs, 34 refs. Paris, 1956.

The author reviews the distribution and systematic position of *Thaumetopoea* (*Cnethocampa*) *pityocampa* (Schiff.), which is widely distributed on pine in Yugoslavia, and records observations on its bionomics. In the laboratory, the threshold of development was 12°C. [53·6°F.] for the eggs and 6°C. [42·8°F.] and 11°C. [51·8°F.] for larvae in the fifth and first instars, respectively. In the field, the temperature inside the nests was considerably higher than outside, and the development of the larvae was accelerated in winter in the parts of the nests most exposed to the sun. The larvae are gregarious and could not be reared individually. Adults emerged between 30th July and 14th September, and protandry was marked, though less so in the field than in the laboratory. Factors regulating variations in the intensity of infestation are discussed. The adults and larvae appear earlier inland than on the coast, which is apparently an adaptation to the earlier onset of cold weather inland, the larvae being no longer in the susceptible early instars when the temperature falls.

In 1950, 8 and 18 per cent. of the nests observed in two forests contained larvae showing the symptoms of the virus disease described by Vago [*R.A.E.*, A **43** 95], and in 1951, 10 per cent. of the larvae were attacked by it. It did not appear in 1953, and is considered less important in control

than are parasites. Of the latter, *Ooencyrtus pityocampae* (Merc.), *Tetrastichus* (*Genioccrus*) *tibialis* (Kurd.), *Charitolophus* sp. and *Trichogramma* sp. were reared from the eggs, and *Compsilura concinnata* (Mg.), *Sarcophaga haemorroidalis* (Fall.), *Conomorium eremita* (Först.), *Villa* (*Anthrax*) *hottentotta* (L.) and *Thyridanthrax velutinus* (Mg.) from the pupae; the last two had not previously been recorded from this host. The pupae were also parasitised by *Ichneumon rudis* Boy. and *I. coniger* Tischb., which were too rare to be of importance.

[Vasit' (K.) & Sisoyevit' (P.).] Vasić (K.) & Sisojević (P.). **Paraziti obične borove zolje** (*Diprion pini* **L.**) **i njihova uloga u regulaciji brojnosti ove štetočine na Maljenu 1951–1952 godine.** [Parasites of *D. pini* and their Action during an Outbreak in the Maljen in 1951–52.] —*Plant Prot.* no. 27 pp. 3–43, 6 pls., 2 figs., 2 graphs, 10 refs. Belgrade, 1955. (With a Summary in French.)

Investigations on the parasites attacking *Diprion pini* (L.) on pine in the Maljen mountains, in Serbia, were begun in 1950, at the beginning of the outbreak of that sawfly there [*cf. R.A.E.*, A **44** 278]. *Achrysocharella ruforum* (Krausse) [*cf. loc. cit.*] was the only parasite reared from the eggs of *D. pini*. It was unevenly distributed, and though the percentage parasitism reached 100 on some trees, it was much lower on neighbouring ones. In all, 14 parasites and two hyperparasites were reared from the cocoons, and a list of these is given, with notes on abundance and on the bionomics of some of them. The most numerous were *Spilocryptus adustus* (Grav.), which parasitises the eonymphs of both generations and remains in diapause for 1–3 years with its host, *Microcryptus basizonius* (Grav.), which has similar habits, and *Exenterus amictorius* (Panz.) (*marginatorius* (F.)) and *E. oriolus* Htg., which attack the full-fed larvae. In 1951–52, nearly 46 per cent. of the first-generation cocoons were destroyed by natural enemies and about 37 and 29 per cent. of the second generation were destroyed by parasites and other natural agencies, respectively. The less abundant parasites included *Monodontomerus strobili* Mayr, and in an appendix in French and Croat by J. R. Steffan, adults of both sexes of this Torymid are described. It was originally thought to be phytophagous, but was reared in three successive years from cocoons of *D. pini*.

Bjegović (P.). **Avio-zamagljivanje gusenica gubara u Metohiji 1954 godine.** [A Mist applied by Aeroplane against Larvae of the Gipsy Moth in the Region of Metohija in 1954.]—*Plant Prot.* no. 27 pp. 65–77, 1 map, 2 refs. Belgrade, 1955. (With a Summary in English.)

Oak woods over an area of some 15,500 acres in the region of Metohija, in southern Serbia, were treated against larvae of *Lymantria dispar* (L.) between 30th May and 7th June 1954 with a DDT mist applied from an aeroplane (a Junkers 34 being chiefly used). A solution of 33 per cent. DDT was applied at about 1·8 lb. per acre, and treatments were directed towards the edges of the woods, where infestation was heaviest, to prevent spread. Most of the larvae were in the second and third instars, and excellent control was obtained.

Djurkić (J.). *Tetranychus atlanticus*, **štetočina pamuka kod nas.** [*T. atlanticus*, a Pest of Cotton in Yugoslavia.]—*Plant Prot.* no. 27 pp. 121–123, 1 fig., 6 refs. Belgrade, 1955. (With a Summary in French.)

Mites that caused damage to cotton in the Vojvodina in 1954 were identified as *Tetranychus atlanticus* McG. The crop is a fairly recent one in the area and had not previously been injured by pests.

Zotsenko (L. N.). *Eulecanium corni* **Bouché (Homoptera, Coccoidea) on a subtropical Plant—Persimmon.** [*In Russian.*]—*Ent. Obozr.* **34** pp. 67–76, 11 refs. Moscow, 1955.

Persimmon in parts of the Province of Krasnodar has since 1950 been attacked by *Eulecanium corni* (Bch.), and investigations on the bionomics and natural enemies of this Coccid were carried out in 1952. It is widely distributed in the southern parts of the Soviet Union, and attacks a great variety of fruit trees and bushes. In the region under investigation, its main food-plants were plum and *Corylus tubulosa*. In severe outbreaks on plum, the twigs were very heavily infested, leading to dropping of leaves and fruits, die-back and even the death of the trees. In 1951, the twigs of persimmon were found to be similarly infested, the numbers of Coccids increasing to about 1,600 per linear foot of twig by autumn on some trees, but spraying with a 4 per cent. emulsion of solar oil in winter gave effective control, decreasing the infestation to about eight per ft. Overwintering took place in the second nymphal instar on the two-year-old wood of the various food-plants, to which the crawlers migrated from the leaves. Many of them ascended the trees from leaves that had fallen to the ground, and such individuals sometimes attached themselves temporarily to the trunks or main limbs, continuing their migration later to the twigs, feeding on which was essential for further development. Some of the crawlers died on the fallen leaves. Mortality during hibernation ranged from 5·6 to 28·6 per cent., and development was resumed in April, when the daily temperature averaged 11·6°C. [52·88°F.] for the first fortnight and 8·3°C. [46·94°F.] for the second, and the adult females appeared between the end of April and mid-May and the males from 25th April to 5th May. Males did not occur on persimmon and formed only 2–3 per cent. of the population on plum. Oviposition began on 3rd May, and the minimum, average and maximum numbers of eggs laid per female were 325, 736 and 1,023, respectively, on plum, and 316, 449 and 592 on persimmon. The crawlers hatched from 18th June and migrated to the lower surfaces of the leaves, from which the second-instar nymphs later moved to the twigs for hibernation. In 1952, this occurred from 29th September to 23rd October on plum and from 15th October to 16th November on persimmon, the earlier migration on plum being attributed to the premature dropping of the leaves caused by a fungous disease.

The natural enemies observed attacking *E. corni* comprised the fungus, *Cephalosporium lecanii*, various predacious Coccinellids, and four insect parasites, *Coccophagus lycimnia* (Wlk.), *C. scutellaris* (Dalm.), *Cheiloneurus formosus* (Boh.) and *Encyrtus sylvius* Dalm. The two species of *Coccophagus* parasitised the nymphs, but were of little importance, as they mainly attacked other insects, and *Cheiloneurus* occurred only sporadically. The most effective was *E. sylvius*, which destroyed up to about 96 per cent. of the eggs, is restricted to species of *Eulecanium*, and attacks the eggs of even single females when the population is low. Its habit of hibernating apart from its host allows the application of sprays in early spring without reduction of biological control.

Savzdarg (V. É.). **Peculiarities of the seasonal Development and Feeding of the Apple Gall Aphid (Homoptera, Aphidoidea) in Connection with the Development of Control Measures.** [*In Russian.*]—*Ent. Obozr.* **34** pp. 77–87, 3 figs., 8 refs. Moscow, 1955.

Observations in 1951–52 in the Province of Moscow on the bionomics of *Anuraphis* (*Yezabura*) *devecta* (Wlk.) confirmed the earlier finding [*cf. R.A.E.*, A **40** 219] that its whole annual cycle is completed on apple in that

part of the Soviet Union. There were 3–4 generations a year. Hatching of the winter eggs began in late April and early May, and the immature fundatrices settled on the lower surfaces of the young leaves, causing the formation of galls at the edges. They became adult about mid-May and reproduced by mid-June. Their offspring distributed themselves in groups over the lower surfaces of the leaves and caused the appearance of discoloured spots or gall-like deformations and wrinkling. Adults of this generation were present by mid-June and included a few alate migrants. Adults of the third generation appeared in the second half of June and also included a few migrants, together with a few oviparae and winged males. Oviparae and males formed the majority of the fourth generation, in July, but the males were very rare. Overwintering eggs were present on the trunks of the trees by mid-July. The appearance of the different forms is described. The numbers of progeny produced per apterous parthenogenetic female fell from 50 in the first generation to 12 in the third, which indicated a progressive decline in vitality, and the scarcity of winged migrants restricted the spread of infestation. The oviparae laid only 2–3 winter eggs each, and many of these were not fertilised, as the males were so few.

Investigations in mid-June on the density of the colonies and the damage caused by the Aphid showed that the younger leaves situated towards the tips of the shoots were the most heavily infested, reacting to the attack by the formation of galls, whereas older leaves were less infested and developed only necrotic spots. The young, actively growing parts of a leaf were preferred. Observations on 33 varieties of apple showed well marked differences in attractiveness and resistance, resistant varieties coming early into bearing. Trees that were well spaced and were situated on higher ground also showed lower infestation. Biochemical investigations, the results of which are given in a table, showed metabolic disturbances in the infested leaves. Several insecticides were tested against the Aphid in the laboratory and field, and sprays of 0·05 and 0·1 per cent. of an emulsion concentrate containing 30 per cent. parathion, applied to the upper surfaces of the leaves, gave 90 and 100 per cent. mortality, respectively, in two days. Treatment is best applied in spring, before the appearance of the second generation.

Smol'yannikov (V. V.). **Data on the Ecology of the Noxious Little Tortoise—*Eurygaster integriceps* Put. (Hemiptera-Heteroptera, Pentatomidae) in Ciscaucasia.** [*In Russian.*]—*Ent. Obozr.* **34** pp. 88–92, 1 graph, 13 refs. Moscow, 1955.

Observations to the north of the Caucasus showed that the habits of *Eurygaster integriceps* Put. differed somewhat from those recorded in Central Asia [*cf. R.A.E.*, A **40** 309], the adults that developed in grain fields flying directly to their hibernation quarters in mid-July, so that aestivation and hibernation could not be clearly differentiated. In tests, the lower threshold of egg development was about 6–8°C. [42·8–46·4°F.]. The development of the eggs and first-instar nymphs lasted 5 and 2·5–3 days, respectively, at 30°C. [86°F.] or more, irrespective of humidity, whereas that of the former lasted at least 20 days at lower temperatures. Cold rigidity of the adults occurred at 6–7°C. [42·8–44·6°F.] in summer, but only at 1°C. [33·8°F.] in winter. Adult feeding began at 12°C. [53·6°F.], and mating and oviposition at 16–18°C. [60·8–64·4°F.], with the maximum of intensity at 24–32°C. [75·2–89·6°F.]. Flight occurred at 20–22°C. [68–71·6°F.], and a depression of activity at about 40°C. [104°F.]. Temperatures of 47–48°C. [116·6–118·4°F.] were lethal.

The adults left their hibernation quarters in late April, when the air

temperature reached 20–22°C., and dissections at that time showed that their fat content was reduced to almost half its original amount and their water content increased. Owing to the low temperatures that prevailed at the beginning of May, bugs in the fields at first took refuge under lumps of earth, on weeds or densely-sown cereals, on which most of the eggs were laid. The nymphs needed to feed on the ears for normal development and sometimes reached the second or even the third instar without feeding. After feeding began, the fat content increased with each instar, but its ratio to the weight of dry material remained almost unchanged. The nymphal stage lasted 35–45 days under favourable conditions. The fat content of the newly emerged adults fell at first but increased rapidly after a few days, and the storage of carbohydrates began. Feeding continued until the removal of the grain at harvest led to unfavourably high temperatures on the soil surface, and the bugs then left for their hibernation quarters. The fat reserves were used up most rapidly by the males in autumn and early winter and by the females during the second half of the hibernation period, this being attributed to the completion of sexual maturation by the males before the onset of diapause, whereas maturation of the females began only in December or January.

The cold-resistance of the different stages was investigated in numerous experiments. Some of the eggs died at −3°C. [26·6°F.] and all at −10°C. [14°F.], and the corresponding temperatures for nymphs in the first instar were −7·8°C. [17·96°F.] and −10°C. Cold-resistance of adults indicated a correlation with fat content. Young adults containing 12 per cent. fat and 72 per cent. water, collected from grain fields in 1938, showed little mortality at −5°C. [23°F.], whereas more than half died at −9°C. [15·8°F.]. Cold-resistance increased in autumn, when complete mortality occurred at −15·2°C. [4·64°F.], single individuals dying at −6°C. [21·2°F.] and more than half at −8·5°C. [16·7°F.], but it was reduced again in October–November, when some of the bugs died at −4·5°C. [23·9°F.] and half of them at −6°C., and still more at the end of November and during December, when more than half the bugs died at −5·5°C. [22·1°F.]. Greater cold-resistance was shown by adults collected in 1939, which entered hibernation with greater food reserves and the fat content of which in January–March was as great as that of the other bugs just before hibernation. Some individuals tested in the second half of winter died at −7°C. [19·4°F.], over half of them at −8°C. [17·6°F.], and all at −15·8°C. [3·56°F.], though a few individuals survived exposure for 15–20 minutes to −16·9°C. [1·58°F.]. Observations carried out at the hibernation sites indicated that under snow-cover even air temperatures of −18 and −20°C. [−0·4 and −4°F.] were harmless to most of the bugs hibernating beneath fallen leaves, since temperatures there did not fall below −6°C. [21·2°F.]. After a protracted thaw, nevertheless, even mild frosts may lead to the almost total extinction of the overwintering population. After the resumption of activity in spring, and especially before flight to the fields, cold-resistance decreased, some individuals dying at −1°C. [30·2°F.], more than half at −5°C. and almost all at −10°C.

Kreĭtsberg (V. É.). **A new Species of Thrips (Thysanoptera) injurious to Pistachio.** [*In Russian.*]—*Ent. Obozr.* **34** pp. 95–98, 4 figs., 3 refs. Moscow, 1955.

Descriptions are given of the adults of both sexes of *Liothrips jakhontovi*, sp.n., which occurs in Turkmenia, Afghanistan and Persia and causes considerable damage to pistachio (*Pistacia vera*). Investigations in

Turkmenia in 1935–37 showed that it had 6–7 generations a year, development being completed in about 19–25 days. The adults hibernated under loose bark, became active in April, and sucked the sap of the opening buds, inflorescences and young leaves; later the young fruits were attacked. The eggs were laid at the feeding sites, singly or in batches of 5–10. The infested plant parts became distorted, and some of the fruits fell prematurely or were delayed in ripening. In one locality, 14·3 per cent. of the fruitlets fell owing to infestation. The removal of superfluous shoots and loose bark considerably decreased the damage.

Glushchenko (A. F.). **The Clover Weevil as a Pest of Clover in the Province of Leningrad (Coleoptera, Curculionidae).** [*In Russian.*]—*Ent. Obozr.* **34** pp. 99–107, 15 refs. Moscow, 1955.

Hypera (*Phytonomus*) *nigrirostris* (F.) was found to be a major pest of clover in the Province of Leningrad, and observations on its bionomics and control were carried out in 1950–52. In laboratory tests, the adults fed on several species of clover, but preferred red clover (*Trifolium pratense*) and did not attack lucerne, peas or vetch (*Vicia sativa*). The overwintered adults fed on the leaves, petioles and young stems, but caused little damage to the rapidly growing plants. Most of the injury was caused by the larvae, which occurred only on red clover in the field. Those in the first instar attacked the buds and young, unopened leaves, whereas those in the later instars damaged the developing buds, the green or flowering heads, and the growing tips. The larvae generally appear earlier than do those of *Apion* spp., and attack the largest terminal buds. On one farm, infestation of the clover heads by *H. nigrirostris* ranged from 18·3 to 49·6 per cent. in the three years and that by *Apion* from 23 to 41·2 per cent., some heads being infested by larvae of both.

The adults hibernated beneath litter and in the upper layers of soil in the clover fields or outside them and resumed activity in early spring when the air temperature reached 7–9°C. [44·6–48·2°F.]. Pairing and oviposition began a few days later, and oviposition reached its peak in the second half of May and at the beginning of June. The eggs were laid singly or in batches of up to nine beneath the epidermis of the leaves, the daily production averaging 7–8 eggs per female and ranging from 1 to 18; the maximum total laid by any female was 855. Oviposition was irregular and sometimes ceased for several days. Eggs laid in the first ten days of May hatched in 18–25 days at average daily temperatures of 6·3–15·8°C. [43·34–60·44°F.], and larvae were first observed on 19th May in 1951 and 28th May in 1952, cocoons, which were formed in the clover heads, on 20th and 29th June, and newly emerged adults at the end of June or in early July. In the laboratory, where the average daily temperature ranged from about 17°C. [62·6°F.] to nearly 25°C. [77°F.], the egg, larval and pupal stages lasted 8–11, 21–25 and 5–9 days, respectively.

Since the larvae are difficult to reach with insecticides, control measures for use on seed crops should be directed mainly against the adults in spring, before mass oviposition begins, and combined treatment against *Hypera* and *Apion* is thus possible. When a 5 per cent. DDT dust was applied at 22·5 lb. per acre in 1951 and 1952, very good control of *H. nigrirostris* was obtained in three days, and infestation of the heads was reduced from 38·3 to 11·6 per cent. in 1951 and from 23·4 to 12·1 per cent. in 1952. On crops grown for hay, prompt cutting and the destruction of the adults as they leave the stacks are recommended.

Shutova (N. N.) & Kukhtina (A. V.). **Parasites and Predators of Pests subject to Quarantine Regulations and several other Pests of agricultural Plants.** [*In Russian.*]—*Ent. Obozr.* **34** pp. 210–217. Moscow, 1955.

A systematic list is given of 99 insect parasites (including a few hyperparasites) and predators found associated with major pests, mainly Coccids, of *Citrus*, deciduous fruit trees and bushes, forest trees, subtropical plants and ornamentals in the Soviet Union, showing their hosts and the places where they occur.

Khadzhibeĭli (Z. K.). **A new Genus and Species of Lecaniidae (Homoptera, Coccoidea) from Georgia.** [*In Russian.*]—*Ent. Obozr.* **34** pp. 231–239, 3 figs., 2 refs. Moscow, 1955.

The new Lecaniine described is *Neopulvinaria imeretina*, gen. et sp.n. It infests grape vine in western Georgia and was previously confused with *Pulvinaria vitis* (L.), which is present in the area. In the laboratory, it also developed on mandarin orange. Descriptions are given of the sexually immature adult female, the adult male, the nymphs and the scale of the male nymph. *N. imeretina* has one generation a year. The fertilised females overwintered on the branches and stocks, oviposition beginning at the end of May, when the vines were in flower. Before oviposition, the body of the female increased considerably in size, owing to which some of its specific morphological features became indistinct. The numbers of eggs laid per female varied with size, the maximum being 3,000 or more. The egg stage lasted about a month, mass emergence of the crawlers being observed between 18th and 25th July. The crawlers attached themselves to the green parts of the plant; on the leaves, they settled along the veins on the lower surfaces. Feeding by the nymphs and the development of sooty mould on the honeydew excreted by them caused general weakening of the plants. Mass emergence of the adults and pairing occurred in mid-September, the males dying and the females entering hibernation at the end of the month. Many of the eggs were destroyed by the larvae of *Hyperaspis campestris* (Hbst.) and *Leucopis* sp., and the nymphs were attacked by several parasites, of which *Coccophagus lycimnia* (Wlk.) and an unidentified species of the same genus were the most abundant.

Batiashvili (I. D.). **Pests of *Citrus* and other subtropical Fruits.** [*In Russian.*]—$8\frac{3}{4} \times 5\frac{3}{4}$ ins., 312 [+2] pp., 6 col. pls., 82 figs., $4\frac{1}{2}$ pp. refs. Tiflis, Gruz. sel'skokh. Inst., 1954. Price 8 *rub.*

In view of the recent increase in the cultivation of *Citrus* and other subtropical fruits in the southern parts of the Soviet Union, knowledge of the pests that attack the trees and means of controlling them is essential. This book consists of introductory sections on the work of Russian entomologists in this field, conditions in the three climatic zones into which the Black Sea region can be classified, with the pests that are of most importance in them, the ways in which the pests are spread, the damage that they cause, and the various methods of control available, including the use of chemical and biological methods, followed by information on the morphology, distribution, bionomics and control of individual pests (mostly insects and mites) arranged under the plants attacked, and a key for their identification, based on appearance and the type of injury caused.

Annual Report of the West African Cacao Research Institute, April, 1953 to March, 1954.—52 pp., frontis. Tafo, 1954. **Annual Report of the West African Cocoa Research Institute 1954–55.**—110 [+2] pp., frontis., 2 maps. Tafo, 1955. **1955–56.**—90 [+2] pp., frontis., 1 map. 1957.

These reports on investigations on cacao in the Gold Coast and Nigeria [*cf. R.A.E.*, A **43** 79] during 1953–56 include sections dealing with work on the swollen-shoot virus, mealybugs and Mirids (Capsids). All three contain records of native and introduced plants found susceptible or not susceptible to strains of the virus in the Gold Coast, and the first includes a list showing changes in nomenclature of some plants previously tested. The correct names for those previously recorded as *Corchorus tridens* [**43** 79], *Cola cordifolia* [**38** 378; **39** 372] and *C. togoensis* [**39** 372: **43** 79] are *Corchorus olitorius*, *Cola gigantea* and *C. millenii*, respectively.

Work in the Gold Coast on the transmission of the New Juaben strain of the virus by mealybugs is described by W. T. Dale in all three reports. In 1953–54, young adults of *Pseudococcus njalensis* Laing that were starved for 18 hours and allowed to feed on infected plants for 24 hours and then on healthy dissected beans for varying periods transmitted the virus to 64 and, on one occasion, 80 per cent. of the latter after feeding on them for two hours, and to 80–87 per cent. after feeds of 4–64 hours. In investigations on the optimum conditions for transmission in 1954–55, preliminary starving appeared to have no direct influence, since 43 per cent. transmission was obtained following starvation for 0 or 48 hours and 25 per cent. after starvation for three hours [*cf.* **39** 47]; the effect may, however, have been masked by the long infection feed (16 hours). Some individuals became infective after feeding on diseased plants for two hours or less, but the optimum period was 16–24 hours, and longer feeding periods appeared to reduce transmission. In the following year, first- and second-instar nymphs and young adults very occasionally transmitted the virus after access to infected plants for only 90 minutes. In 1954–55, healthy plants became infected after transmission feeds of 15 minutes; the infection rate rose rapidly as the feeding period was increased up to one hour and more slowly as it was further increased up to four hours [**37** 86; **39** 47]; when the vectors settled rapidly, the optimum period was two hours. The virus could be acquired and transmitted in as little as five hours. It was further found that, under optimum conditions, a cacao bean is almost certain to become infected when fed on by ten infective adults [*cf.* **39** 47]. Nymphs in all instars and young adults, all at a rate of three per test bean, were equally efficient as vectors, but in 1955–56 more transmissions were obtained with a higher number of nymphs than with a smaller one of adults. In tests in 1954–55, *P. concavocerarii* James transmitted the New Juaben strain, though not very efficiently. In the third report, it is stated that the Peki strain was transmitted to a low percentage of test plants by *P. njalensis* and *Planococcus citri* (Risso), and that *P. kenyae* (Le Pelley) is an efficient vector of the New Juaben and Kpeve strains.

Studies on mealybugs are reported by P. B. Cornwell. Observations on their movements recorded in 1955–56 showed that first-instar nymphs and adults comprise over 90 and less than 2 per cent., respectively, of the mobile population of *Pseudococcus njalensis* on cacao trees. Mobile individuals occurred at all levels, but 85 per cent. of both moving and static populations were found in the canopy. Over a period of four months, significant positive correlations were found between numbers of mobile mealybugs and temperature and, to a less extent, hours of sunlight, but not with changes in the evaporating capacity of the air. Sunlight begins to penetrate the canopy at about noon, and movement continues from then, probably in response to

increased temperature in the carton tents built by ants over the colonies [*cf.* **39** 369], until about 6 p.m., with a maximum at about 3 p.m. It was confirmed by the use of mealybugs rendered radioactive with ^{32}P that movement occurs from tree to tree through the canopy where the branches interlock. During work in 1954–55 on the effect of wind on movement, more mealybugs were caught on adhesive traps at heights of 2 and 10 ft. above ground in closed cacao than in and above the canopy. In the third report, catches of air-borne mealybugs at different levels in closed and open canopies are stated to be closely related to the pattern of wind movement, which is greatly affected by the condition of the canopy. Trap catches in 1954–55 provided no evidence that vector dissemination is greatest along roads and paths [*cf.* **36** 111]. Some 200 mealybugs, including only one specimen of *P. njalensis*, were collected on seedlings placed in exposed places at different distances from established cacao and protected from ants; apparently all species are equally dispersed by wind, but the degree to which they become established is influenced by the amount of exposure at the traps. When seedlings banded against ants were placed under and round a large tree (*Ceiba pentandra*), in an area with no prevailing wind, subsequent infestation was heaviest on those in deepest shade; *P. njalensis* was not represented. Catches on both seedling and adhesive traps increased during the dry season and declined during the early rains. In 1953–54, ants tending mealybugs labelled with ^{32}P were found to be rendered radioactive by the honeydew excreted by the latter; this provides a means of detecting their nests.

In the third report, F. E. Decker describes a method for the mass rearing of *P. njalensis* on potato sprouts [*cf.* **40** 364] in a room in which temperature and humidity were kept at about 77°F. and 94 per cent., respectively, and the glass window was replaced by wire gauze to provide conditions suitable for ants, in the absence of which the colonies were smothered by moulds that developed on the honeydew. Owing to difficulties in providing conditions favourable for the sprouting tubers, only small numbers of mealybugs were reared.

In connection with work on the chemical control of mealybugs, H. R. Mapother & J. Nicol describe field trials in 1953–54 in which dimefox [bis(dimethylamino) fluorophosphine oxide] was introduced into cacao trees at various rates through holes bored at the base of the trunk with their centres 2 or 4 ins. apart. Counts made six weeks later on the felled trees indicated that total populations and populations exclusive of those on pods are likely to be reduced to about one mealybug per tree by dimefox at rates of 240 and 160 parts per million, respectively, calculated on the weight of the tree above ground [*cf.* **44** 7]; the distance between the holes made no difference. In the second report, Mapother describes a similar trial under different rainfall conditions and concludes that a rate of 261 p.p.m. is most likely to be effective under the range of conditions investigated. Survival decreased with increasing rate of application, especially at the lower dosages, and was lowest at rates between 280 and 320 p.p.m. Populations increased much less during the first six weeks after treatment than during the next three weeks; the rate of increase was twice as great on treated as on untreated trees. In 1953–54, the stumps of the treated trees showed discoloration, and dead and morbid cells were found in them. In further trials, there was considerable leaf fall from trees that received an initial dose of 250 p.p.m. and four subsequent ones at 100 p.p.m. In the second year, some trees that received seven applications at intervals of eight weeks remained normal, but others showed leaf scorch and withering, often followed by severe die-back of the branches and copious production of chupons; all recovered when treatment was discontinued.

Decker records further work on biological control [**43** 80] in the first two

reports. Parasites were imported in both years and tested against mealybugs. *Anagyrus pseudococci* (Gir.) from California was successfully reared on *P. njalensis*, *Planococcus citri* and *Dysmicoccus* (*Pseudococcus*) *brevipes* (Ckll.) in the first year and also on *Pseudococcus adonidum* (L.) (*P. longispinus* (Targ.)) in the second, and *Acroaspidia myrmicoides* Comp. & Zinna, likewise from California, was reared on *P. njalensis*, *Ferrisiana* (*Ferrisia*) *virgata* (Ckll.) and *Phenacoccus madeirensis* Gr. in the second year. Over 165,000 examples of five species were liberated in 1953–54, and nearly 290,000 in the next year, when releases were confined to Tafo. The only species recovered was *Pseudaphycus angelicus* (How.), which was reared from mealybugs collected in three districts in the second year and is consequently believed to be established [*cf.* **43** 80]. *Scymnus sordidus* Horn, which is predacious on mealybugs, was introduced from California in 1955. It was reared on *Pseudococcus njalensis*, *D. brevipes* and *F. virgata* and released at Tafo.

In connection with work on Mirids, D. J. Taylor states in the first report that attempts to measure populations of *Sahlbergella singularis* Hagl. and *Distantiella theobroma* (Dist.) by the release and subsequent recapture of marked adults were unsuccessful, and that figures obtained by applying a pyrethrum spray as a fine mist to the canopy and collecting the bugs that fell on to cloth spread over an area of 48 sq. yards beneath the trees [*cf.* **41** 168] agreed well with the results of routine collections during late November and December, but gave lower numbers in January. Attempts to sample populations by means of light-traps are described in the second and third reports. In the second, a modified Robinson trap [**43** 169] is stated to have been more effective than the Rothamsted trap, and a mercury-vapour lamp than a filament bulb. A highly significant correlation existed between the monthly variations in population of *S. singularis* as shown by collections from two mercury-vapour light-traps and one filament-bulb trap operated from April 1955 to March 1956 and by the routine collections made over the same period. *D. theobroma* was rarely caught at light, and marked adults released within 25 ft. of a light-trap were not attracted to it. *Bryocoropsis laticollis* Schum. was trapped fairly frequently during August–November at a mercury-vapour light, but *Helopeltis bergrothi* Reut. was rarely taken. Comparison of monthly fluctuations in populations of *S. singularis* and *D. theobroma* in 1954–55 with meteorological data for the same period showed a significant negative correlation between populations and the mean daily saturation deficiency two months earlier. Intensive fortnightly observations in a plot with a complete canopy and one in a Mirid pocket, in which the canopy had been destroyed and temperatures were in consequence higher and the air drier, showed that both Mirids were considerably more numerous in the pocket plot, *D. theobroma* being dominant, whereas the reverse was true of *H. bergrothi* and *B. laticollis*. A method of sampling populations by means of egg counts is described by P. F. Entwhistle in the third report. Satisfactory results were obtained by counting eggs on chupons and fans on immature cacao, provided that a sufficiently large sample was taken, and in order to extend the method to mature trees, studies on the vertical distribution of eggs were begun in February 1956. Most were found within 5 ft. of the top, and their distribution appeared to be determined by light. Chupons were preferred as oviposition sites, but fans were of more importance on mature trees owing to their greater abundance. In work in 1955–56 on the association of fungi with Mirid lesions, described by G. Usher, *Calonectria rigidiuscula*, which usually occurs in its conidial stage (*Fusarium decemcellulare*), was isolated from 11 per cent. of a total of 216 field-collected adults of *S. singularis* and *D. theobroma*. The spores were carried only on the legs and bodies of the

Mirids, so that the relation is fortuitous, and other tests showed that they are unlikely to be air-borne.

Work on the chemical control of Mirids is recorded by F. Raw in the third report. In laboratory tests, BHC was considerably more toxic than DDT, aldrin, dieldrin or chlordane to nymphs and adults of *D. theobroma* confined on pods that had been sprayed and allowed to dry; aldrin was next in toxicity. At 30–35°C. [86–95°F.], first- and fifth-instar nymphs and adults caged over, but not in contact with, leaves bearing dry deposits from a spray of 0·25 per cent. BHC were all killed by exposure for 120, 240 and 30 minutes, respectively; aldrin had less fumigant action. The toxicity of deposits of DDT and BHC on leaves and pods to nymphs under normal shade conditions in the field did not apparently persist for more than four weeks, but BHC deposits appeared to inhibit feeding even when no longer toxic. It is concluded that insecticides with rapid action are more likely to be effective than less toxic and more persistent ones. The superiority of BHC in the field is probably due to its fumigant action, which would be of advantage in mature cacao, where complete coverage is almost impossible to obtain. In field trials described by Taylor, 1 part BHC concentrate (20 per cent. γ BHC) in 3 parts diesel fuel oil applied by means of a swingfog thermal fog generator [*cf.* **42** 393] gave complete mortality of adults and nymphs of *D. theobroma* caged at a height of 12–15 ft. in mature cacao in 2½ and 12 hours, respectively, at a distance of 10 ft., and in 20 and 36 hours at 60 ft.; a further test indicated that reasonably good control of adults and nymphs could be expected at 100 ft. When the fog was applied to mature cacao over an area of 10½ acres, mortality among adults and nymphs after 24 hours was 68 and 31 per cent., respectively, at 79 ml. concentrate per acre and 95 and 43 per cent. at 144 ml. In the second report, Mapother gives the results of tests of the treatment of young, bearing cacao with emulsified solutions of 1·25 and 2·5 per cent. DDT and 0·03 and 0·06 per cent. BHC. The sprays were applied by means of compressed-air equipment fitted with a lance and special nozzle that produced a solid cone of spray of narrow angle and relatively coarse droplets. They were applied in short bursts to the jorquettes and branch unions at intervals of five and later of four months over a period of 18 months, and all treatments gave effective control. The last application was made by means of a mist-blower because the trees had grown too tall for the other equipment. In a small-scale trial of the phytopathological effects of the DDT sprays, applications at 1·25 and 2·5 per cent. made five times at fortnightly intervals by means of the compressed-air sprayer or as a heavy spray did not injure the trees, but applications at 5 per cent. caused tip-scorch, especially in a heavy spray. Taylor & R. Wickens describe tests begun on three-year-old Amelonado cacao in June and two-year-old Upper Amazon cacao in August 1954 to determine the value under Gold Coast conditions of the method of combined cultural and chemical control of Mirids developed in the Belgian Congo [**44** 452]. The results obtained after 22 months are given in the third report by Taylor. On Amelonado cacao, the numbers of Mirids and of damaged shoots were both lower on cacao from which the chupons had been removed than on unpruned trees, and the differences were highly significant; furthermore, on unpruned trees the damaged shoot was usually the leading chupon, whereas on pruned trees it was a fan and the effects were less serious. Pruning was advantageous, and a closed canopy had formed. The insecticidal treatment comprised fortnightly applications of a 5 per cent. DDT dust to recently damaged trees or treatment every three months with an emulsified solution of 1·25 per cent. DDT applied to all trees by means of the compressed-air equipment, and the latter proved the more effective. On Upper Amazon cacao, there were no

significant differences between pruned and unpruned trees or between the insecticidal treatments, and although growth was good, a continuous canopy was not formed.

In studies in January–March 1956 on insect pollinators of cacao in the Gold Coast, described by H. M. Entwhistle, *Forcipomyia ingrami* Carter, *F. ashantii* Ingram & Macfie and *Lasiohelea litoraurea* Ingram & Macfie [*cf.* **39** 285] were found in less than 0·1 per cent. of the flowers and were much less common than Cecidomyiids, which occurred in 12–15 per cent.

All three reports contain sections dealing with work in Nigeria. R. M. Lister & J. M. Thresh state in the first that *Tylococcus westwoodi* Strickl. transmitted three isolates of the swollen-shoot virus from the Western Region in preliminary tests. R. G. Donald records research on cacao mealybugs and their natural enemies in all three years. The results of surveys detailed in the second report indicate that *Planococcus citri* is the commonest, being about twice as numerous as *P. kenyae* or *Pseudococcus njalensis*. Other species present include *F. virgata* and, less commonly, *D. brevipes*, *P. bukobensis* Laing, *P. concavocerarii* and two other species near *P. proteae* Hall and *P. gahani* Gr. In general there was no seasonal variation in population. These results were obtained from samples collected from ground level, and the accuracy of the method was tested by making counts on felled trees for comparison. It was found that the mealybugs collected from ground level represented 0–87·5 per cent. of the total population on individual trees, though most species were represented both in collections from the ground and in those from the canopy. The average number of individuals per colony for all species together was highest in collections at ground level, despite the predominance in the canopy of *P. njalensis*, which forms large colonies [*cf.* **39** 372]. *F. virgata* and *P. concavocerarii* were most frequent in flowers, young pods and growing buds. Natural enemies were surveyed in 1953–55, and they are stated in the second report to include 19 primary parasites, of which seven are not common, and three hyperparasites. *Leptomastix bifasciatus* Comp. was the most abundant primary parasite and was responsible for 25 per cent. of the total parasitism; it attacked all the commoner mealybugs. *Neodiscodes martinii* Comp. was the next commonest; it caused 15 per cent. of the total parasitism and was reared mainly from *Planococcus citri*, *P. kenyae* and *Pseudococcus njalensis*. It is stated in the third report that a species of *Pseudaphycus* near *orientalis* Ferrière that was collected in Nigeria in November 1955 appears to be identical with a parasite that was introduced into the Gold Coast from the United States in 1953 but is not known to have become established. Of the hyperparasites recorded in the second report, *Cheiloneurus carinatus* Comp. represented about 90 per cent. and is stated in the first to attack *L. bifasciatus*, *N. martinii* and probably *Anagyrus* spp. The commonest predators were the larvae of two or more Cecidomyiids, which usually prey on the nymphs but sometimes develop as external parasites on a single adult host, often reducing or inhibiting egg production. Other predators of mealybugs included ten Coccinellids and the larvae of two Lycaenids, *Spalgis lemolea* Druce and *Aslauga vininga* (Hew.), of which the former preys on all stages of *F. virgata*, *Phenacoccus madeirensis* and *Planococcus citri*, and the latter on all stages of *Pseudococcus njalensis*. The commonest Coccinellids were *Platynaspis higginsi* Crotch, which is found mainly in ant-attended colonies of *Pseudococcus njalensis*, *Planococcus kenyae* and, less frequently, *P. citri*, and *Scymnus* sp., which most commonly attacks colonies of *P. citri* either unattended by ants or attended by *Pheidole* spp. Studies on Mirids are described by J. M. Thresh in the third report. Observations on trees coppiced two years earlier as a method of regeneration following Mirid damage and just beginning to bear pods

showed that the method is likely to be successful only on trees of which the fan canopy has not been completely destroyed. Minor insect pests of cacao recorded by Donald are *Earias biplaga* Wlk., which attacks the terminal buds, and *Tragocephala gorilla* Thoms., which rings the bark a few inches below the apical bud before oviposition. The larvae of the latter bore in the stems and may kill chupons or seedlings. Lister & Thresh state that *E. biplaga* is the most serious pest on the chupons of coppiced trees, killing the growing point. Similar, but less widespread damage by *T. gorilla* was largely confined to the rainy season.

Corbet (P. S.). **Duration of the aquatic Stages of** *Povilla adusta* **Navás (Ephemeroptera: Polymitarcidae).**—*Bull. ent. Res.* **48** pt. 2 pp. 243–250, 7 figs., 5 refs. London, 1957.

Povilla adusta Navás is widespread in Africa. The larvae damage the underwater parts of wooden structures, and both the larvae and adults are fed upon by several species of fish in Lake Victoria, Uganda. Studies on the life-cycle of this mayfly were carried out there and are described in detail. Adult emergence showed a well-defined rhythm, occurring shortly after full-moon, and since the adults live for only about one hour, the duration of the aquatic stages must be an integral number of lunar months. A generation appeared to be completed in 4–5 months, the egg stage lasting about two weeks.

Pradhan (S.) & Rangarao (P. V.). **Effect of Post-treatment Temperature on Insect Resistance to insecticidal Sprays.**—*Bull. ent. Res.* **48** pt. 2 pp. 261–274, 6 graphs, 28 refs. London, 1957.

In continuation of earlier work [*R.A.E.*, A **37** 408] and in view of the published results of other investigators [*cf.* **38** 248; **39** 87, 173; **40** 38; **41** 261, etc.], laboratory tests were made in which the effects of pre-treatment, treatment and post-treatment temperatures on the toxicity of insecticides were differentiated. In this paper, post-treatment temperature is dealt with. The test insects were adults of *Tribolium castaneum* (Hbst.), and they were kept prior to treatment at about 14°C. [57·2°F.], a low pre-treatment temperature having been found to lead to consistent results, and sprayed in petri dishes 12·5 cm. in diameter in an apparatus based on the Potter tower [**40** 185]. The insecticides comprised emulsified solutions of pure p,p′DDT, γ BHC and parathion and technical toxaphene and chlordane, and a suspension of pure DDT, each applied in six or seven concentrations at a rate of 2 cc. spray per dish. After treatment, the insects were kept in clean tubes at constant temperatures of 12–40°C. [53·6–104°F.] and observed for mortality at intervals of about 48 hours. Median lethal concentrations were determined from the data obtained on the fourth day, and the following is based on the authors' summary of the results.

In the tests with DDT and γ BHC, mortality decreased with rise of post-treatment temperature from about 14 to 30°C. [86°F.] and increased when the temperature rose from 30 to 40°C., but with toxaphene, chlordane and parathion, mortality increased continuously with increase of temperature from 14 to 40°C. As a possible explanation of such divergent results, it is tentatively suggested that whereas the inherent physiological resistance of *Tribolium* to DDT and γ BHC, which appears to increase with increase of temperature up to a certain point, has been demonstrated, the technique was not sufficiently critical for the other materials, to which the physiological resistance possibly remained masked by other factors, so that the

median lethal concentrations obtained do not provide a true index to it. An essential similarity between the curves obtained by plotting these values against temperature for DDT and γ BHC and curves relating temperature to other physiological activities published by various investigators is stressed.

Srivastava (P. D.). **Studies on the Choice of Food-plant and certain Aspects of the digestive Physiology of the Larvae and Adults of** *Athalia lugens proxima* **(Klug) and** *Epilachna vigintioctopunctata* **(F.).**—*Bull. ent. Res.* **48** pt. 2 pp. 289–297, 19 refs. London, 1957.

Laboratory and field observations were made in India on the factors responsible for the choice of food-plants by *Athalia lugens* subsp. *proxima* (Klug), a sawfly that attacks young cruciferous crops and shows a preference for turnip, and *Epilachna vigintioctopunctata* (F.), which is a pest of solanaceous plants, especially brinjal (*Solanum melongena*). It is concluded that the smell, taste and age of the plants are all of importance in the case of *Athalia*, and smell and taste in that of *Epilachna*. In investigations on digestion in these two insects, the hydrogen-ion concentrations of the salivary gland, foregut, midgut and hindgut of the larvae of *Athalia* were found to range from 6·4 to 7, and those of the adult from 6·2 to 6·6, and the corresponding figures for the larvae and adults of *Epilachna* were both 5·4–6·8. No enzymes are secreted by the foregut and hindgut of the larvae or adults of either species; in both larvae and adults of *Athalia*, the salivary glands and the midgut epithelium secrete amylase, and the midgut epithelium also maltase, invertase, lactase, lipase and protease. The salivary glands of the larvae of *Epilachna* secrete amylase, but those of the adults do not, and the midgut epithelium of both larvae and adults secretes amylase, maltase, invertase, lactase and protease. The midgut of both larvae and adults of *Epilachna* secretes lipase also, although no more than traces are detectable in the adults. The proteases in both insects act in slightly acidic media.

Banerjee (S. N.) & Basu (A. C.). **Experiments with a systemic Insecticide for the Control of** *Schoenobius incertulas* **(Wlk.) (Lepidoptera, Pyralidae), a Stem Borer of Paddy in West Bengal.**—*Bull. ent. Res.* **48** pt. 2 pp. 299–303, 1 fig., 2 refs. London, 1957.

The following is almost entirely the authors' summary. Experiments were carried out in West Bengal to ascertain whether the paddy stem borer, *Schoenobius incertulas* (Wlk.) (*incertellus* (Wlk.), *bipunctifer* (Wlk.)), could be controlled by Tetrax 1, a systemic insecticide containing technical schradan equivalent to approximately 42 per cent. octamethyl pyrophosphoramide and approximately 25 per cent. triphosphoric acid penta(dimethylamide). In a preliminary field experiment in 1953, soaking the rice seed in a 0·1 per cent. water solution of the insecticide prior to sowing had little effect on the damage caused by the borer, but the yield of grain was higher from a treated plot than from a control plot. A further experiment was carried out in the following year in which the seed was soaked in a 0·1 per cent. solution of Tetrax 1 for eight hours before sowing in the seed beds. The seedlings were lifted about 2½ months later and steeped in a 0·1 per cent. solution for eight hours before being transplanted into two plots, each 32 × 32 ft. About three weeks later, the plants were sprayed with a solution of the same strength. Two plots of similar size, in which the rice had received no treatment, were maintained as controls. Again there was very little difference between the treated and untreated plots in the damage

caused to the ear heads by the pest, but the treated plots produced 108·68 lb. grain as against 77·27 lb. for the untreated plots. The increase was largely due to an increase in the number of heads per plant. The incidence of the borer was too low in both experiments to determine whether Tetrax 1 exercised any appreciable control of infestation.

EASTOP (V. F.). **The Periodicity of Aphid Flight in East Africa.**—*Bull. ent. Res.* **48** pt. 2 pp. 305–310, 11 refs. London, 1957.

The following is virtually the author's summary. Continuous trapping of winged Aphids was carried out with Moericke trays (shallow trays painted yellow and filled with water) [*cf. R.A.E.*, A **39** 359] and a suction trap for two years at a site at 6,850 ft. above sea level in Kenya [*cf.* **44** 411], and with Moericke trays, for four months only, at a site at 1,200 ft. in southern Tanganyika. The trap data show a marked seasonal periodicity of flight (three-quarters of the annual catch in June and July) at the Kenya site. The large catch is a reflection of a large increase in population following the rains. A similar relation between size of catch and the period of the rains is indicated by the data from Tanganyika. Successive hourly catches with a suction trap show no distinct diurnal double peak of aerial density such as occurs in Europe.

GEROLT (P.). **Method for Breeding, Handling and Sexing Adults of *Drosophila melanogaster* Mg. as a Test Insect for Bioassay.**—*Bull. ent. Res.* **48** pt. 2 pp. 311–315, 1 pl., 1 graph. London, 1957.

The following is based on the author's summary. A method is described by which a continuous and plentiful supply of adults of *Drosophila melanogaster* Mg. of known age and sex can be efficiently produced for use in microbioassay tests. Equal numbers of males and females were introduced into breeding jars containing a nutrient medium (consisting of maize flour, sugar, brewer's yeast and agar-agar powder mixed with water and a fungicide) and kept at 24–25°C. [75·2–77°F.] and 60–80 per cent. relative humidity. They were removed after ten days, just before the emergence of their adult progeny. Emergence of adults began and reached a peak earlier and a more constant sex ratio and a higher number of progeny per female and, consequently, of flies per jar, were obtained when the nutrient medium was placed on a layer of cotton-wool to absorb excess liquid, its surface was broken into irregular lumps, and a hole in the centre was filled with cotton-wool than when the surface was even and covered with a pad of cotton-wool to provide pupation sites, whether the absorbent layer was present or not. As the emerging flies are positively phototropic, the culture jars were enclosed during the emergence period in a darkened box with an exit funnel leading into a collecting jar that was replaced daily, so that practically all the newly emerged flies were removed within 24 hours, and the age of any batch was accurately known to within a day. Males were found to be twice as susceptible as females to dieldrin when exposed for 48 hours to deposits on filter paper, and since they also gave a greater response to differences in dosage of toxicant, they are to be preferred for use in bioassay experiments. The sexes were quickly and efficiently separated by anaethetising the flies with carbon dioxide and placing them in a glass-covered container through which a mixture of carbon dioxide and air (3:1) was passed in a gentle and continuous stream and from which the males were removed individually by means of an aspirator passed through the side.

Potter (C.) & Gillham (E. M.). **Effect of Host-plant on the Resistance of *Acyrthosiphon pisum* (Harris) to Insecticides.**—*Bull. ent. Res.* **48** pt. 2 pp. 317–322, 12 refs. London, 1957.

The susceptibility of insects to insecticides has been shown to vary with the plant or plant part on which they develop [*cf. R.A.E.*, A **28** 485; **31** 16, 277, 329; **40** 334] and as evidence was obtained in Britain that *Macrosiphum* (*Acyrthosiphon*) *pisum* (Harris) differed in susceptibility to rotenone when reared on broad bean (*Vicia faba*) and red clover (*Trifolium pratense*), the difference was further investigated in laboratory experiments in 1943–56. Ten tests were made in which adult, apterous, viviparous, parthenogenetic females reared on broad bean or clover were sprayed in petri dishes in a Potter tower [**40** 185] with rotenone at different concentrations and subsequently confined in the dishes at 20°C. [68°F.] and 50–60 per cent. relative humidity, mostly for 24 hours, after which mortality counts were made. The following is substantially the authors' summary of the results. In nine tests, the Aphids from clover were more resistant than those from broad bean, the ratios of the LD50's ranging from 1·1 to 2·5, and in five of these tests the differences were significant. In the remaining test, the Aphids from broad bean showed a small but not significant increase in resistance over those from clover. The Aphids from clover were generally smaller than those from broad bean. Although the total amount of poison retained by the larger individuals from broad bean was found to exceed that retained by the smaller ones from clover, the amount retained per unit body weight was greater in the latter. It appears, therefore, that while the results obtained might be due, at least partly, to the greater total weight of poison retained by the larger individuals, the difference in resistance between the insects from the two plants might be even greater if the poison were applied on the basis of equal weight of poison per unit of body weight. Since the difference in resistance between the Aphids from the two plants did not appear to depend primarily on difference in size, it might be due to difference in nutrition. Aphids reared on clover were found to have a significantly higher proportion of dry matter in their composition than those reared on broad bean.

Walker (P. T.). **Insecticide Studies on East African agricultural Pests. I. *Epilachna hirta* (Thnb.). II. *Cylas puncticollis* Boh.**—*Bull. ent. Res.* **48** pt. 2 pp. 341–347, 2 graphs, 14 refs. London, 1957.

These are the first two parts of a series on the chemical control of insect pests of crops in East Africa and contain the results of laboratory trials of toxicants against *Epilachna hirta* (Thnb.) and *Cylas puncticollis* Boh. in Kenya. The adults and larvae of *E. hirta* feed on the foliage of potato, wheat, maize, oats, barley, sunflower and cotton and occasionally reach outbreak numbers. In the tests, weighed quantities of dust were blown upwards by compressed air into a bell jar containing adults and allowed to settle on them for varying periods. Dusts containing 0·5 or 2 per cent. parathion applied at rates to give 0·24–0·74 and 0·98–2·97 mg. toxicant per sq. ft., respectively, were the most rapidly effective, and even the lower concentration gave almost complete mortality in 24 hours. A dust of 5 per cent. DDT at rates giving 0·36–5·82 mg. technical DDT per sq. ft. was less rapid in action but gave very good results by the end of three days. A proprietary BHC dust, used at rates giving 0·23–1·04 mg. γ isomer per sq. ft., was less effective and, even at the highest rate, gave complete mortality only after eight days.

C. puncticollis causes severe losses of sweet-potato tubers in Kenya and,

with *C. formicarius* (F.), is also common in Uganda. Adults were sprayed in a Potter tower [**40** 185] with emulsified solutions of 0·02, 0·1 and 0·5 per cent. DDT, γ BHC, aldrin or dieldrin at a rate of 0·813 mg. spray per sq. cm., and the median lethal concentrations were found from mortality counts made 18 hours later to be 2·4, 3·2, 4·9 and 10·4 mg. per 10 ml. for the four insecticides, respectively. DDT, γ BHC and aldrin at the highest concentration gave complete kill in 18, 18 and 72 hours.

Cornwell (P. B.). **An Investigation into the Effect of cultural Conditions on Populations of the Vectors of Virus Diseases of Cacao in Ghana with an Evaluation of seasonal Population Trends.**—*Bull. ent. Res.* **48** pt. 2 pp. 375–396, 16 figs., 7 refs. London, 1957.

The following is almost entirely the author's summary of this account of observations in Ghana on the seasonal population density under different cultural conditions of the mealybug vectors of the swollen-shoot disease of cacao (chiefly *Pseudococcus njalensis* Laing) and associated insects. The observations were made fortnightly from January 1954 to February 1955 in cacao growing in dense secondary bush and under well cultivated conditions, and no attempt was made to differentiate the mealybug species. The percentages of cacao trees infested by mealybugs (termed the infestation rate), the numbers of mealybug colonies and the mealybug populations were similar under the two cultural conditions. Populations of ants of the genus *Crematogaster* and of Coccinellids were higher in bush plots than in cultivated ones. Populations of ants of the genus *Pheidole*, though smaller than those of *Crematogaster*, were greater in plots of well maintained cacao. Correlations of infestation rates and populations were compared under the two cultural conditions for mealybugs, ants, predators (Coccinellid and Cecidomyiid larvae) and parasites, of which *Anagyrus pullus* Comp. and *Clausenia* spp. were the most numerous. The field data showed an exponential relation between these factors, which was rendered linear by suitable transformations. The correlation of mealybug populations with infestation rate and with populations of parasites and predators was equally high in both habitats. The correlation of mealybug populations with those of *Crematogaster* was closer in the bush than in well maintained cacao, but the implications of this are not fully understood. There was a higher infestation rate during the first three months of the year. In contrast with results recorded in a paper already noticed [*R.A.E.*, A **39** 369], significant changes, of a five- or six-fold order, were found in the mealybug population during the year. These seasonal changes were based on mean mealybug populations per infested tree, and were largely the results of changes in the numbers of colonies; populations showed a decline during the first six months of the year and then rose to a maximum during October–November. The data suggest that these trends may be brought about largely by changes in the abundance of predators and parasites.

Swaine (G.). **Trials on the underground Storage of Maize of high Moisture Content in Tanganyika.**—*Bull. ent. Res.* **48** pt. 2 pp. 397–406, 1 pl., 6 refs. London, 1957.

The following is based partly on the author's summary. Since storage in underground pits gave satisfactory protection of maize with a moisture content of less than 13·5 per cent. in tests in Tanganyika [*cf. R.A.E.*, A **44** 136], the pits constructed at Moshi and Morogoro were further used to determine the value of the method for the storage of maize of higher

moisture content. The pits were refaced, the rubberoid top of the Moshi pit was given a coat of aluminium paint, and the Morogoro pit was sealed with an underlayer of asphalt-saturated felt (concreting paper) and an overlayer of a hessian-base damp course, which were covered with hot bitumen. The average moisture content of the maize when placed in the pits was 16·9 per cent. at Moshi and 14·8 per cent. at Morogoro, and the general level of insect infestation was very light and fairly light, respectively. The predominant species was *Calandra oryzae* (L.); *Oryzaephilus surinamensis* (L.) and *Tribolium castaneum* (Hbst.) were also present. The maize was kept in the sealed pits for 144 and 374 days, respectively. Samples taken at intervals by means of a grain spear showed that insect infestation died out early, and there was no increase in insect damage. Changes unconnected with insect infestation took place in the grain, however, and conditioning and admixture of a more palatable maize were necessary before it could be offered for sale. It is concluded that long-term underground storage of maize of high moisture content is not practicable under tropical conditions owing to deterioration of the grain.

MacCuaig (R. D.) & Sawyer (K. F.). **The cumulative Toxicity of Dinitro-o-cresol applied in small Doses to Locusts.**—*Bull. ent. Res.* **48** pt. 2 pp. 435–445, 6 graphs, 5 refs. London, 1957.

The following is largely the authors' summary. By the method of attacking flying swarms of locusts with insecticides sprayed directly into the swarm by relays of light aircraft, a proportion of the swarm receives a sub-lethal dose from each sortie. For successful operation it is essential that a substantial contribution to the final mortality should be produced by the accumulation of these sub-lethal doses on individual insects over a period of time. The object of the experiments described was to determine whether such doses applied at intervals are wholly additive in their effects. The poison used was a 20 per cent. w/w solution of DNC in oil and, to shorten the procedure, the test insects (adults of *Schistocerca gregaria* (Forsk.) and *Locusta migratoria migratorioides* (R. & F.)) were treated with a single drop of poison applied to the ventral surface of the abdomen by a micro-drop syringe. Regular daily doses of about 3–9 μg. DNC per gm. body weight were found not to be wholly cumulative in their effect. After the second or third day, the lethal effect of each dose became steadily less, and after the fourth or fifth day it was negligible, indicating that a steady state had been reached in which the rates of application and loss of insecticidal activity in the survivors are equal. When the dose was applied in two halves, with various time intervals between them, the cumulative effect during the first 24 hours was less in *S. gregaria* than in *L. m. migratorioides*. In the latter, it is possible that sensitisation occurs. After three days, the first half-dose had fallen to an estimated 20 per cent. of its initial effectiveness in each species. The two species were equally susceptible to a single dose of 7–18 μg. DNC per gm. body weight. The males were more susceptible than the females to daily doses (the amounts required for 50 per cent. kill of *S. gregaria* in four days being 5·6 and 8·6 μg. per gm., respectively) but probably not to single doses. Resistance to a daily dose was correlated roughly with resistance to a single dose, the total dose required to produce 50 per cent. mortality in four days being about twice the median lethal dose for a single application. If flight activity does not materially affect the results, it is evident that the non-cumulative effects of sub-lethal doses could cause a serious loss in the efficiency of an air-spray operation that was unduly prolonged. Thus, a quantity of insecticide sufficient to kill over 99 per cent. of the locusts if applied as a single dose would kill less than 40 per cent. if the application were spread over four days.

Gough (H. C.). **Studies on Wheat Bulb Fly** (*Leptohylemyia coarctata* (Fall.)). **IV. The Distribution of Damage in England and Wales in 1953.**—*Bull. ent. Res.* **48** pt. 2 pp. 447–457, 1 graph, 2 maps, 15 refs. London, 1957.

Infestation of wheat by *Hylemyia* (*Leptohylemyia*) *coarctata* (Fall.) was severe in Britain in 1953, and in this fourth part of a series [*cf. R.A.E.*, A **37** 408, etc.] the author surveys the amount and distribution of damage caused by it. The outbreak is attributed to high populations of adults in the summer of 1952, when the weather was probably favourable for oviposition, and low temperature in autumn, which delayed the development of the wheat, so that it was susceptible to damage when the larvae appeared in January–February. It was further suggested that the low temperature while the eggs were in diapause would probably result in early hatching. The following is almost entirely the author's summary of the results of the survey. It is estimated that in 1953, as a result of attack by *H. coarctata*, 59,000 acres of wheat were redrilled and 58,000 acres were patched with spring-sown wheat; another 85,000 acres were affected without any action being taken. The cost of new seed and the reduction of yield of spring wheat as compared with winter wheat represent a minimum financial loss of about £1,200,000. It is shown on maps that the distribution of damage was similar to the distribution of wheat and to the area with less than 30 ins. rainfall annually. In districts where over 5 per cent. of the combined crops and grass acreage is under potatoes, there is a tendency for the amount of damage by *H. coarctata* to increase with increasing potato acreage. It is tentatively suggested on circumstantial evidence that high rainfall on the west side of the country is partly responsible for the absence there of damage by *H. coarctata*. Many of the variations in the distribution of damage on the eastern side of the country could be accounted for by differences in cropping. In Scotland, the distribution of the fly is also confined to the eastern side. There appear to be no records of its occurrence in Northern Ireland, but it occasionally infests wheat in the Republic of Ireland, where, however, it is not likely to cause reductions in yield.

Heron (R. J.). **Studies on the Starvation of Last-instar Larvae of the Larch Sawfly,** *Pristiphora erichsonii* (Htg.) (**Hymenoptera: Tenthredinidae**).—*Canad. Ent.* **87** no. 10 pp. 417–427, 4 figs., 11 refs. Ottawa, 1955.

Outbreaks of *Pristiphora erichsonii* (Htg.) on larch in Canada are commonly associated with a marked reduction in leaf production by the affected trees [*cf. R.A.E.*, A **39** 436], as a result of which the sawfly population declines owing to larval mortality and a reduced reproductive rate among the survivors, both brought about by lack of food. Quantitative investigations of the sub-lethal effects of starvation during the fifth (last) larval instar were made in Manitoba and Saskatchewan. In the laboratory, the mean duration of the feeding period during the fifth instar was normally 9·4 days; 80 per cent. of the total feeding takes place during this instar, and 20–30 per cent. of it during the first three days. Larvae allowed to feed only for these three days consumed rather less than half as much foliage as fully fed larvae and almost all died. Larvae starved throughout the last instar were completely immobilised and unable to feed after 4–5 days. Larvae fed or starved for the first three days constructed their cocoons about four and two days later than the control larvae, and those that fed for five days constructed them one day earlier than the controls. The weight and the lipid contents of the larvae were determined in late December and early January, when

they were in diapause, and significant differences were found between fully fed and part starved individuals; reduced feeding was accompanied by marked reductions in both wet and dry weight and in lipid reserves, and there were significant differences between groups in lipid content estimated as a percentage of wet weight, but not of dry weight. The percentage water content increased slightly with the period of starvation, presumably owing to retention of metabolic water. Microscopic examination of fat-bodies stained for differentiation of lipids showed the cells of fully fed larvae to be heavily laden with large fat inclusions, whereas those of partly starved larvae contained smaller, scattered fat globules, usually at the periphery.

Among field-collected insects, diapausing larvae originating from completely defoliated trees were significantly lighter and their lipid contents were lower than those of larvae from a partly defoliated tree. An experiment in which the mean wet weights of fully fed larvae collected from trees at progressive stages of defoliation were compared showed that starvation had no significant effect until defoliation exceeded 90 per cent. Fully fed larvae collected in 1953 from an area in Manitoba in which defoliation had been severe for several years and was complete in 1953 were found to be, on an average, 18 per cent. lighter than similar individuals from an area in Saskatchewan in which the population had only recently become heavy and defoliation was light. The mean reproductive capacity of females reared from larvae from the former area was found, by dissection, to be over 40 per cent. lower than that of females from the latter area; there was a strong positive correlation for each population between adult weight and number of mature oocytes, but no appreciable difference in the mean number of eggs laid per shoot.

It is concluded that partial starvation is symptomatic of prolonged outbreaks and that annual fluctuations in mean reproductive capacity, dependent on annual variations in population density due to mortality factors, occur as the foliage becomes insufficient to support the increasing population; starvation is always imminent, however, owing to the restricted foliage supply. The size of egg clusters is nevertheless unlikely to decrease to any extent, since it is probably more nearly related to phenological and tree-growth factors. Although starvation is accompanied by a decrease in the mean number of oviposition sites utilised per female, the latter is also related to adult density.

Green (G. W.) & deFreitas (A. S.). **Frass-drop Studies of Larvae of *Neodiprion americanus banksianae* Roh. and *N. lecontei* (Fitch) (Hymenoptera: Diprionidae).**—*Canad. Ent.* **87** no. 10 pp. 427–440, 8 figs., 7 refs. Ottawa. 1955

Field and laboratory studies were carried out in Ontario in 1953–54 on the value of frass-drop measurements in assessing the density and age of larvae of *Neodiprion banksianae* Rohw. and *N. lecontei* (Fitch) on pine [*cf. R.A.E.*, A **40** 158, etc.]. The frass produced by the larvae was collected by means of a funnel, through which it fell into vials arranged in two concentric circles on a collecting disk that was rotated electrically so that each vial was beneath the funnel for an hour; each disk served two collecting funnels. The following is based almost entirely on the authors' summary of the results. Temperature appeared to be the most important weather factor affecting feeding rates. Larvae of both species in all the instars tested (second-fifth and third-sixth, respectively) fed at about 6–38°C. [42·8–100·4°F.], and feeding reached a peak at about 32°C. [89·6°F.]. Field studies were hampered by the presence of *Spathimeigenia erecta* Aldr. and *Exenterus platypes* Cushm. [**32** 149], which parasitised larvae of both

species, especially during and after the third instar, and disrupted the feeding continuity of the colonies. Larvae in colonies visited by parasites dropped less frass than undisturbed larvae, presumably as a result of parasitism. Larvae of *N. lecontei* produced more frass when feeding upon foliage of the current year than upon that of the previous year, and at 35·5°C. [95·9°F.] the mean frass drop from the new foliage was 32 per cent. greater than that from the old. Laboratory and field results agreed well only for the earliest instars tested. More frass was produced in the laboratory than in the field, where the reduction may have been due to low night temperatures or parasitism or both. It is concluded that frass-drop measurements are of value in studies of the effect of meteorological factors on the feeding activity of the two sawflies, provided that parasites can be controlled, in estimating the age composition of populations on trees too high for visual checks and in following population trends. Extension of the method to obtain estimates of population density might lead to great errors, however.

Salt (R. W.). **Extent of Ice Formation in frozen Tissues, and a new Method for its Measurement.**—*Canad. J. Zool.* **33** no. 6 pp. 391–403, 6 graphs, 12 refs. Ottawa, 1955.

The following is virtually the author's summary. Use of the calorimetric and dilatometric methods for determination of ice in frozen tissues is criticised, and a method based on terminal melting points determined after various degrees of drying is proposed. The theoretical background of such a method lends support to it, and experimental work with gelatin is especially convincing. Use of this method on blood of *Loxostege sticticalis* (L.) gave results conforming in general to those obtained by other workers with calorimetric and dilatometric techniques, and also to those obtained with salt solutions. The amount of water that is bound is shown to be very low, as in mammalian, frog, and fish muscle. The possible influence of bound water in insect cold-hardiness is discussed, and the conclusion is reached that it has little if any protective effect [*cf. R.A.E.*, A **31** 17].

Holling (C. S.). **The Selection by certain small Mammals of dead, parasitized, and healthy Prepupae of the European Pine Sawfly, *Neodiprion sertifer* (Geoff.).**—*Canad. J. Zool.* **33** no. 6 pp. 404–419, 2 pls., 3 graphs, 13 refs. Ottawa, 1955.

Small mammals are of importance in reducing populations of some forest insects, especially those that construct cocoons in the soil [*cf. R.A.E.*, A **16** 511; **30** 465; **31** 213; **45** 57, etc.]. During work on their influence on populations of *Neodiprion sertifer* (Geoffr.) on pine in Ontario, they were found to open up to 70 per cent. of the cocoons, and the degree of selectivity shown by them was accordingly investigated to determine the degree of control afforded. The following is largely based on the author's summary of the results. In cage experiments, *Sorex cinereus cinereus*, *Blarina brevicauda talpoides*, and *Peromyscus maniculatus bairdi* opened more cocoons containing healthy, living prepupae than ones containing prepupae attacked by fungus. In the field and in the laboratory, *Sorex* opened more cocoons containing healthy prepupae than parasitised ones, but the reverse appeared to be true for *Blarina*, and *Peromyscus* opened equal numbers of cocoons containing parasitised and unparasitised prepupae. *Sorex*, which is highly insectivorous, and *Blarina*, which is less so, showed greater selective ability than *Peromyscus*, which is omnivorous [*cf.* **38** 183]. Pretreatment of

Peromyscus by providing only cocoons containing prepupae attacked by fungi for seven nights lowered ability to select cocoons containing healthy rather than infested prepupae, whereas pretreatment by providing only cocoons containing healthy prepupae increased it. In studies with *Sorex*, the degree of selection in the digging, opening, removing and eating phases of feeding showed a progressive increase with each phase. Selective ability was acquired with experience in the first three phases, but was innate in the eating phase.

Duncan (J.) & Couture (R.). **Notes biologiques sur les pucerons de la pomme de terre dans l'est du Québec.**—*Ann. ent. Soc. Quebec* **1** (1954–55) pp. 57–60. Quebec, 1956.

In view of the importance of virus diseases of potato in Quebec, observations were made in the months of July–September from 1950 to 1953 on the Aphids that infest the crop in the east of the Province. The species found were *Macrosiphum solanifolii* (Ashm.), *Myzus persicae* (Sulz.), *Aphis abbreviata* Patch and *Macrosiphum solani* (Kalt.) (*Myzus convolvuli* (Kalt.)), and they represented 64·73, 29·15, 5·82 and 0·3 per cent., respectively, of the total population for the four years together. In 1951, when climatic conditions were unfavourable for *M. solanifolii*, *A. abbreviata* predominated, and in 1952, *Myzus persicae* was the most numerous. Populations of *Macrosiphum solanifolii* reached a peak in the second half of August, and those of *Myzus persicae* about two weeks later. *A. abbreviata* increased from early August until no green parts remained on the plants. The percentages of the Aphid population found on the top, middle and bottom leaves averaged 32·9, 22·8 and 44·3, respectively, for the four years. *Macrosiphum solanifolii* showed a preference for the upper parts of the plant, and *Myzus persicae* for the base. The percentages of alates observed among populations of these two species averaged 3·6 and 0·9, respectively.

Robert (A.). **Note sur un dermestidé adventice dans la faune du Québec, *Perimegatoma vespulae* Milliron (Coléoptères).**—*Ann. ent. Soc. Quebec* **1** (1954–55) pp. 61–63. Quebec, 1956.

Megatoma (*Perimegatoma*) *vespulae* Milliron was found damaging specimens in an entomological collection in Quebec. This Dermestid had not so far been recorded from eastern Canada, and it was possibly introduced with material received from the central United States.

Paradis (R. O.). **Essais de traitements insecticides dans la lutte contre la tordeuse à bandes rouges, *Argyrotaenia velutinana* (Wlk.) (Lépidoptères: Tortricidae) dans le sud-ouest du Québec.**—*Ann. ent. Soc. Quebec* **1** (1954–55) pp. 66–76, 4 refs. Quebec, 1956. (With a Summary in English.)

Eulia (*Argyrotaenia*) *velutinana* (Wlk.) has increased in recent years on apple in south-western Quebec, particularly where repeated applications of DDT have been made against the codling moth [*Cydia pomonella* (L.)], and insecticides were tested in 1952–54 for its control. In 1952, wettable-powder sprays containing 1·5 lb. 15 per cent. parathion per 100 gals. applied on 28th May and 5th June, or on 28th May only, and 1·5 lb. 50 per cent. DDD per 100 gals. applied on 28th May or 5th June, gave over 95 per cent. control of the first generation, but the same sprays were less effective when applied rather late, on 7th August, against the second

generation. In 1953, the first generation was well controlled by the DDD spray applied on 28th May, and also by a spray containing 2 lb. 25 per cent. wettable malathion per 100 gals. and one of 3 pints of an emulsion concentrate containing 50 per cent. 1,1-bis(p-ethylphenyl)-2,2-dichloroethane [ethyl-DDD] per 100 gals., both applied on 28th May and 11th June. Against the second generation, 93–100 per cent. control was given by the DDD spray and by sprays containing 1 or 2 lb. 25 per cent. wettable malathion or 1·5 pints 50 per cent. malathion emulsion concentrate per 100 gals., applied on 5th August. In 1954, wettable malathion applied at both rates on 31st May and 8th June, or at the higher rate on 8th June only, the malathion emulsion spray applied on both dates, and a spray containing 3 lb. 50 per cent. wettable Strobane (chlorinated terpenes) per 100 gals. applied on both dates, all gave good results, malathion being significantly better than Strobane. When applied on 10th August against the second generation, these sprays gave rather poorer results, as also did a spray of 1 lb. 15 per cent. wettable parathion per 100 gals. It is concluded that treatment against the first generation should be applied within 4–5 days of the hatching of 95–98 per cent. of the eggs, but that treatment against the second generation will be effective only if applied immediately 95 per cent. of the eggs have hatched. One application against each generation is sufficient, but both surfaces of the leaves must be covered.

Turner (N.). **Tests for Type of Action of Hydrocarbon Insecticides applied jointly.**—*Bull. Conn. agric. Exp. Sta.* no. 594, 24 pp., 9 graphs, 28 refs. New Haven, Conn., 1955.

In view of the possibility that insects would be less likely to develop resistance to two insecticides with different modes of action than to those with similar action [*cf. R.A.E.*, A **28** 200], chlorinated insecticides were injected singly or in mixtures into the abdominal cavity of adults of *Oncopeltus fasciatus* (Dall.) and mortality was observed 48 hours later, in an attempt to determine the type of joint action of the different combinations.

Many of the toxicants clearly acted similarly and would be of little use in controlling insects that had developed resistance to any one of them, but higher mortalities than were expected were given by combinations of chlordane or lindane [almost pure γ BHC] with DDT, fluoro-DDT (DFDT), DDD (TDE), methoxy-DDT (methoxychlor), Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] or Perthane [1,1-bis(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)] and with aldrin and dieldrin, respectively, and by combinations of Strobane [a chlorinated mixture of α-pinene isomers] with DDD or fluoro-DDT, though there was little other evidence of any but similar action. Aldrin or dieldrin with DDD, DDT and ethyl-DDD caused higher mortalities and produced diverging dosage-mortality curves, which might be evidence of interaction.

However, both these results and those obtained by other workers, which are reviewed [*cf.* B **39** 39; **41** 137; **44** 111], showed many inconsistencies; methoxy-DDT and ethyl-DDD acted independently in mixtures, but both produced the same type of result with chlordane and γ BHC; the members of the DDT group that were similar in action did not all act alike when used with Strobane; and chlordane showed high toxicity with aldrin, but not with other members of the aldrin group.

There were great differences in the toxicity of the different compounds to *O. fasciatus*; the median lethal concentrations of γ BHC, aldrin, dieldrin, endrin and isodrin varied from 0·0019 to 0·008 per cent., those of heptachlor and DDT were about 10 and 20 times as great, and those of methoxy-DDT,

Dilan, ethyl-DDD, chlordane, Strobane, DDD and fluoro-DDT ranged up to about 100 times as great. The effect of these large differences on joint action is not known.

The application of insecticides alone and in combination thus failed to indicate the type of toxic action, and it is considered that if such combinations as appeared to produce higher toxicity than that expected from similar action are to be used to prevent the development of resistance, further physiological evidence is desirable.

Shands (W. A.), Simpson (G. W.), Roberts (F. S.) & Muesebeck (C. F. W.). **Parasites of Potato-infesting Aphids and of some other Aphids in Maine.** —*Proc. ent. Soc. Wash.* **57** no. 3 pp. 131–136, 18 refs. Washington, D.C., 1955.

In connection with research on the control of Aphids that infest potato in Maine, parasites were reared in 1942–50 from field-collected examples of *Aphis abbreviata* Patch, *Myzus persicae* (Sulz.), *Macrosiphum* (*Myzus*) *solani* (Kalt.) and *M. solanifolii* (Ashm.) and also from a few other species, including the pea Aphid, *M. pisum* (Harris) (*pisi* (Kalt.)), the turnip Aphid, *Rhopalosiphum pseudobrassicae* (Davis) and the English grain Aphid, *M. avenae* (F.) (*granarium* (Kby.)). Some 15 primary and nine secondary parasites were obtained, and tables are given showing the numbers of each reared from each Aphid and the total numbers of parasites and of each parasite species reared in each year. Indications of new host records for North America up to 1950 are shown.

Aphis abbreviata was attacked by six primary parasites; *Aphidius testaceipes* (Cress.), which was reared from this Aphid only, was the commonest, and *A. nigripes* Ashm., *A. nigriteleus* C.F.Sm., *Diaeretus rapae* (Curt.) and *Trioxys* sp. had not previously been recorded from it. *Myzus persicae* was attacked by 13, of which *D. rapae* was by far the most numerous, *A. nigripes* and *A. nigriteleus* were commoner than the rest, and *A. nigripes*, *A. pisivorus* C.F.Sm., *A. rosae* Hal., *Praon aguti* C.F.Sm. and *P. americanus* (Ashm.) constituted new records. *Macrosiphum solanifolii* was attacked by 11; the commonest were *A. nigripes*, *A. rosae* and *A. pisivorus*, and *A. avenaphis* (Fitch), *A. nigriteleus*, *A. ohioensis* C.F.Sm. and *A. pisivorus* had not previously been recorded from this host. *M. solani* was attacked by four, but parasitism was low; *P. aguti* and *A. nigriteleus* constituted new parasite records for it. *M. pisum* was parasitised only by *P. simulans* (Prov.), *R. pseudobrassicae* by *D. rapae* and *Aphidius* spp., and *M. avenae* by *Praon* sp. and *Aphidius* spp. Many more parasites, and also more hyperparasites, were reared from *Myzus persicae* and *Macrosiphum solanifolii* than from any of the other Aphids.

Kring (J. B.). **Control of DDT-resistant Potato Flea Beetles.**—*Circ. Conn. agric. Exp. Sta.* no. 193, 23 pp., 2 figs., 19 refs. New Haven, Conn., 1955.

In view of reports that DDT did not give satisfactory control of *Epitrix cucumeris* (Harris) on potato in the Connecticut River Valley in 1951 and 1952, field tests were made in three areas in 1953 and 1954 in which sprays of this and several other insecticides were compared against the flea-beetle. All spray quantities given are of actual compound per acre.

DDT failed to give satisfactory protection in two of the areas but was effective at the third. Against both resistant and susceptible populations, it was less effective at 1–2 lb. in a wettable powder than 0·5 lb. wettable

chlordane with either 0·5 lb. wettable aldrin, 0·25 lb. emulsifiable dieldrin, 0·25 lb. wettable Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] or 0·25 lb. wettable or emulsifiable heptachlor, and than 0·5–1 lb. wettable Dilan used alone. Against resistant ones, it was less effective than 0·125 lb. emulsifiable endrin with either 0·5 lb. wettable chlordane or 0·25 lb. wettable Dilan, and than 1 lb. wettable chlordane, 0·5 lb. emulsifiable dieldrin, 0·25 lb. wettable heptachlor, or 0·125 lb. emulsifiable endrin, and, against susceptible ones, it was less effective than 0·5 lb. wettable chlordane with 0·5 lb. wettable DDD (Rhothane), but about equal to 0·5 lb. chlordane with 0·25 lb. wettable Perthane [1,1-bis(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)]; the last two mixtures were not tested against resistant strains.

A mixture of 0·5 lb. wettable chlordane with 0·25 lb. wettable malathion was only about as effective as DDT against resistant and susceptible *E. cucumeris*, but gave very good control of Aphids, mainly *Myzus persicae* (Sulz.) and *Macrosiphum solanifolii* (Ashm.) (*euphorbiae*, auct.) in 1953; chlordane with dieldrin appeared to give some control of these, but populations were considerably higher than on untreated plots after treatment with chlordane mixed with Dilan, ethyl-DDD or heptachlor or after the first three alone. In 1954, all treatments but Dilan, DDT, and chlordane with Dilan kept the Aphids in check. Endrin alone or with chlordane or Dilan and DDT, dieldrin and Dilan alone all protected the plants from *Pyrausta nubilalis* (Hb.), chlordane with dieldrin or Dilan, and DDT, dieldrin, Dilan and endrin alone reduced injury by *Empoasca fabae* (Harris), and chlordane with dieldrin, endrin, heptachlor, malathion or ethyl-DDD, endrin with Dilan, and dieldrin, Dilan and endrin used alone increased the yield of tubers.

Connola (D. P.), McIntyre (T.) & Yops (C. J.). **White Pine Weevil Control by Aircraft Spraying.**—*J. For.* **53** no. 12 pp. 889–891, 2 figs., 5 refs. Washington, D.C., 1955.

Pissodes strobi (Peck) causes serious injury to white pine (*Pinus strobus*) in the north-eastern United States [*cf. R.A.E.*, A **31** 344], the larvae killing the terminal shoots of young trees and inducing malformation. In view of the desirability of using this pine in reafforestation, investigations on the control of the adults by sprays applied from aircraft were made in New York State in 1950–54 in large open plantations of trees 5–15 ft. high.

In 1950–51, a helicopter was used, and a spray prepared from 1 lb. DDT in 2 U.S. pints solvent (Sovacide PD544B), made up with kerosene to 1 U.S. gal., was applied to plots at the rate of 2 U.S. gals. per acre. When the spray was applied in late April 1950 against the overwintered adults in a plantation in which 25 per cent. of the trees had been infested in 1949, 0·1, 14 and 35 per cent. of the trees were attacked in 1950, 1951 and 1952, respectively, as compared with 22, 29 and 33 for no treatment, and when it was applied against the newly emerged adults in mid-September 1950 in a locality in which 29 per cent. of the trees had been damaged in that year, the infestation percentages in 1951 and 1952 were 10 and 22, as compared with 26 and 28 for no treatment. In 1951, the spray was applied in late April to trees of which 30 per cent. had been attacked in 1950, and the infestation percentages were 3, 12, 29 and 31 in 1951, 1952, 1953 and 1954, respectively, as compared with 46, 48 and 40 in 1951, 1953 and 1954 for no treatment. Whereas in April 1950 the trees sprayed were all about 5 ft. high and the helicopter was able to fly low, in 1951 the trees were uneven in height and a poorer deposit was obtained, since the helicopter was forced

to fly higher and there was less down-draught from the rotor. It is concluded, therefore, that helicopters offer no advantage over more economical fixed-wing aircraft in forest plantations, which frequently vary in height.

In 1952, a Stearman biplane was used to treat a large, widely spaced plantation, in which the trees were 5–8 ft. high and had shown 50 per cent. infestation in 1951. DDT was applied at 2 or 4 lb. in 4 U.S. gals. spray per acre in April–May. One of the plots treated at the lower rate showed 2, 6 and 14 per cent. infestation in 1952, 1953 and 1954, respectively, but the others showed less favourable reductions, and the corresponding percentages were 2, 18 and 23 for the plot treated at the higher rate, and 69, 66 and 63 for no treatment. The two best treatments resulted in average increases in height of 6·5 and 7 ft., respectively, in 28 months, as compared with 3·7 ft. for no treatment.

It is concluded that treatment is more effective against the overwintered adults, and since it does not affect the eggs or larvae it should be applied in early spring, before the weevils have oviposited. A plantation can withstand 5–10 per cent. attack each year without economic loss, and control from aircraft is justifiable only when heavier infestation is expected; the reduction in population afforded may render treatment necessary only once or twice during the life of the plantation.

Keifer (H. H.) & Wilson (N. S.). *Eriophyes insidiosus* **Keifer and Wilson, new Species, a new Species of Eriophyid Mite responsible for the Vection of Peach Mosaic Virus.**—*Bull. Calif. Dep. Agric.* **44** no. 4 pp. 145–146, 1 fig., 1 ref. Sacramento, Cal., 1955.

The Eriophyid mite found to transmit the virus of peach mosaic in California [*cf. R.A.E.*, A **44** 247] is figured and described as *Eriophyes insidiosus*, sp. n., from adults taken on *Prunus hortulana* and peach in Riverside County in 1955.

Wilson (H. L.). **Effects of residual DDT on Beet Leafhoppers.**—*Bull. Calif. Dep. Agric.* **44** no. 4 pp. 147–150, 1 graph. Sacramento, Cal., 1955.

DDT is widely used for the control of *Circulifer tenellus* (Baker) in California. Sprays are applied annually between autumn and spring to its winter food-plants along the western side of the San Joaquin Valley to reduce the populations that would otherwise migrate in spring to crops [*cf. R.A.E.*, A **41** 153], and investigations were therefore carried out to determine how long the treatments retained their effectiveness. The standard formula used is 1 lb. technical DDT in 2 U.S. gals. diesel oil per acre, applied as a fine fog from a Buffalo turbine sprayer. After routine spraying, lumps of soil containing small plants of *Erodium cicutarium* and *Plantago insularis* were removed to the laboratory and left exposed to the weather in cages of glass and cloth. Adults of *C. tenellus* confined on these plants were examined 3–6 days later, and the treatment was found to retain its effectiveness for about a month. Mortality was almost complete on *Plantago* but lower on *Erodium*, which grows many times faster than the former and also covers most of the soil surface, giving the insects little opportunity to come into contact with bare soil exposed to the spray. When the test plants were examined 77 days after spraying, no nymphs had developed on treated *Plantago* and very few on treated *Erodium*, but considerable numbers were present on unsprayed plants. Although DDT is assumed to have no ovicidal action, it thus appears that the nymphs die

soon after hatching on sprayed plants. The dead adults found were largely hidden in crevices and under débris, and this would account for earlier failures to observe dead individuals beneath the plants in treated areas.

Outbreaks and new Records.—*FAO Plant Prot. Bull.* **5** no. 9 pp. 145–146. Rome, 1957.

It is reported from the U.S. Department of Agriculture (p. 146) that the spotted alfalfa Aphid [*Myzocallis maculata* (Buckt.)], for which the name *Pterocallidium* sp. is used, had been recorded from 30 States by the beginning of 1957 [*cf. R.A.E.*, A **45** 34], having spread more rapidly than any previous pest introduced into the United States. Observations indicated that mild winters and wind favour development and spread. Losses of lucerne attributable to this Aphid rose from about 5 million dollars in 1954 to nearly 42 million in 1956.

Ogloblin (A.). **Nota sobre el polimorfismo de la langosta.** [A Note on the Polymorphism of the Locust.]—*Rev. Invest. agric.* **9** no. 1 pp. 23–36, 2 figs., 16 refs. Buenos Aires, 1955.

The author describes the development of the phase theory and its application to Old World species of locusts and reviews attempts to apply it in South America, where *Schistocerca paranensis* (Burm.), which occurs in swarms, has been considered by some to be the gregarious phase of the solitary *S. cancellata* (Serv.) [*cf. R.A.E.*, A **41** 218, etc.]. The two forms are morphologically distinct, but there is some intergrading of the hoppers; in typical examples, those of *paranensis* are mainly black with yellow markings, and those of *cancellata* mainly green or straw-coloured.

The author began investigations on the relation of the two forms in Misiones, Argentina, in 1935, when swarms of *paranensis* appeared there, and describes the results, which were summarily published in 1941. In the initial test, five of the hoppers from one egg-pod deposited in the field were isolated in containers about 6 ins. in diameter and 10 ins. high, four being provided with a little moist sand and one with dry sand; the remaining hoppers were reared together in a cage measuring some 24 × 32 × 48 ins. These latter retained their typical *paranensis* coloration, whereas those reared in isolation on moist sand gradually became green, and the one on dry sand turned a light yellowish brown.

It was later noticed that even when reared in considerable numbers in one cage, the hoppers were less active than those in the field. In 1938, in the State of Córdoba, *paranensis* hoppers were observed on groundnuts from the time of hatching. Most of them showed typical *paranensis* coloration and moved in a manner typical of the swarming locusts. Some, however, that were developing in situations from which they could not see the remainder did not join in these movements and after the next moult turned a greenish colour. Similar results were obtained in the laboratory when hoppers were provided with adequate food but kept in small vessels, so that their movements were restricted, and it therefore appears that movement is important for retention of the typical *paranensis* coloration. In a further series of tests with hoppers that were the offspring of typical *paranensis* parents, all those reared together retained the *paranensis* coloration, while those reared in isolation acquired characters typical of *S. cancellata*.

To ascertain whether green solitary hoppers could acquire *paranensis* coloration, an apparatus was devised in which they were stimulated to frequent movement. It consisted of four cages measuring 40 × 4 × 4 ins., having glass ends, and lights were switched on for periods of 15–20 minutes

at each end alternately. Under these conditions, the hoppers began to acquire typical *paranensis* coloration, although they were isolated, but mortality was high. Similar results were obtained when green individuals were placed in cages exposed to the sun containing active gregarious hoppers, the movements of which they imitated.

In 1940, typical hoppers of *S. cancellata* were obtained from Chile and reared to the adult stage. A male and a female were paired with *paranensis* adults from Argentina, and a pair of the Chilean locusts were separated and kept for breeding. The progeny of all these pairs were reared in crowds. In the F_1 generation, they all showed black *paranensis* coloration, but the yellow and orange markings were somewhat less intense than in typical *paranensis* hoppers. Hoppers of the F_2 generation were all typical of *paranensis*.

The author concludes that *S. paranensis* is the gregarious phase of *S. cancellata* and proposes observations to delimit the areas in which transformation occurs, so as to facilitate control. Similar transformation was recorded by Dampf in Mexico, where *S. paranensis* was considered to be the gregarious phase of the solitary *S. americana* (Drury) [*cf.* **15** 527]; the relation of *S. cancellata* to *S. americana* is not known, but if they are identical, the latter name has priority.

KLOMP (H.). **Die morphologischen Merkmale und die Bionomie der Kiefernspanner-Tachine *Carcelia obesa* Zett. (= *rutilla* B.B.).** [The morphological Characters and Bionomics of *C. obesa*.]—*Z. angew. Ent.* **38** pt. 3 pp. 288–294, 5 figs., 8 refs. Berlin, 1956. (With a Summary in English.)

The Tachinid, *Carcelia obesa* (Zett.) (*rutilla* (Br. & Berg.)), is one of the most effective parasites of *Bupalus piniarius* (L.) on pine in Holland, and descriptions are therefore given of all stages, together with a brief account of its bionomics, based on observations over many years. The adults emerged in June and July, the first males appearing about six days earlier than the first females, and the two sexes were about equally numerous. Pairing began a few hours after emergence, but was delayed for 1–2 days in cages, in which the males survived for 21–42 days and the females for 15–52. The adults fed on sugar, honey and water provided separately, but their feeding habits in nature are unknown. Oviposition began three weeks after pairing, and was completed mainly between July and the second half of August. Third-instar larvae were preferred, and the eggs were laid on all parts except the head. The parasite larva hatched in 2–24 hours and entered the host, in which it settled in the wall of the fore-gut, or later in the head muscles. It overwintered in the host pupa, moulting in mid-April and again about the first week of May. The host pupa became immobile shortly before the second moult, and the parasite larva became full-fed 20–25 days later and left it to pupate in the soil nearby. The adult emerged after about four weeks.

ROEDIGER (H.). **Untersuchungen über den Rindenwickler *Enarmonia woeberiana* Schiff. (Lepid. Tortr.).** [Investigations on *E. woeberiana*.] —*Z. angew. Ent.* **38** pt. 3 pp. 295–321, 19 figs., 25 refs. Berlin, 1956.

Enarmonia woeberiana (Schiff.), of which the distribution is reviewed and the immature stages and the reproductive organs of both sexes are described, is a minor pest of stone fruit trees, notably cherry, and occasionally of pear

and apple in Germany. It has recently proved of increased importance in the Palatinate, and its bionomics, natural enemies and economic importance were studied there in 1952–54. There was only one generation a year. The adults were present from 2nd May to 17th August in 1952 and from 27th April to 24th August in 1953, activity being greatest in May. Males and females survived for averages of 3 and 7 days, respectively. Pairing occurred 1–2 days after emergence, and oviposition some 2–4 days later. The eggs were laid on the bark, mostly singly, the number per female ranging from 60 to 90 in nature and from 1 to 86, with an average of 24, in the laboratory. The egg stage lasted 24 days at 12°C. [53·6°F.] and about a week at 25–26·5°C. [77–79·7°F.] in the laboratory, and at optimum temperatures of 16–25°C. [60·8–77°F.] all the eggs hatched. The larvae burrowed into the bark after a few minutes, mostly through wounds, grafting sites and cracks, and mortality was highest at this stage. They tunnelled between the bark and the cambium, preferring wound tissue, but not being confined to any particular level in the tree. They overwintered from mid-October to mid-March, mostly in the fourth but also in the fifth and sometimes in the third instar, and completed their development in the following summer. Infested trees could be distinguished by the accumulations of excreta webbed together with silk that protruded from the tunnels. The pupal stage, which was passed just beneath the bark, but not always in the tunnels, lasted 12–19 days, with an average of 15 days, in the laboratory. Feeding by the larvae generally caused little damage, the injury becoming significant only after several years of infestation. The females showed a marked tendency to oviposit on the trees in which they had developed, which restricted the spread of infestation. The parasites, *Campoplex mutabilis* (Hlmgr.), *Apanteles hoplites* (Ratz.), *Leskia aurea* Fall., and *Hemiteles inimicus* Grav. were reared from the larvae; the last was probably hyperparasitic.

Semal (J.). **Transmission par pucerons de *Cucumis* virus I var. Chr. Noordam de céleri à céleri.**—*Parasitica* **12** no. 3 pp. 71–73, 8 refs. Gembloux, 1956. (With a Summary in English.)

A variety of *Cucumis* virus I was found in celery in Belgium in 1956, and transmission tests with Aphids were carried out in April–June of that year. Adults of *Myzus persicae* (Sulz.), *M. ascalonicus* Doncaster and *Aphis gossypii* Glov. were allowed to feed for 1–2 minutes, after a fast of 2–3 hours, on an infected celery plant and were then kept for three days in groups of ten on healthy young celery. No transmission was effected by *M. ascalonicus* or *A. gossypii*, but symptoms appeared in a fortnight on one of the five young plants on which *M. persicae* had fed, and two of three tobacco plants inoculated with sap from this plant developed characteristic symptoms of infection.

Fowler (V. W.) & Gair (R.). **Notes on the Biology and chemical Control of the Spruce Pineapple Gall *Adelges*.**—*J. R. hort. Soc.* **81** pt. 1 pp. 29–36, 2 pls., 20 refs. London, 1956.

Norway spruce (*Picea abies*) is grown extensively in Britain for the Christmas-tree market, and *Chermes* (*Adelges*) *abietis* L., which causes galls on the shoots, has become an important pest of it in many nurseries in recent years. Experiments on the control of *C. abietis* were carried out at Woking and Darley Dale in 1954–55, and the following is based on the authors' summary of the results. Treatment with 0·05 per cent. BHC in wettable-powder or emulsion sprays in spring gave by far the best results and virtually eliminated the pest. At Darley Dale, it was about equally effective when applied in early or mid-April, but slightly less so when used at the end of that month. Similar results were obtained in one year's tests

at Woking. A single late spray of 0·05 per cent. endrin was less good. A winter spray of 4 per cent. tar distillate was fairly effective, but its use would be limited by weather conditions. Spring sprays of 0·05 per cent. nicotine with a wetting agent gave inadequate control, and parathion, 'mazidox [bis(dimethylamino) azidophosphine oxide], and dimefox [bis-(dimethylamino) fluorophosphine oxide], in sprays, and demeton [diethyl 2-(ethylthio)ethyl phosphorothioate], applied in sprays or by painting the stem and leaves or watering the roots, proved disappointing.

Schøyen (T. H.), Jørstad (I.), Fjelddalen (J.) & Ramsfjell (T.). **Skadedyr og sykdommer i frukt- og baerhagen.** [Pests and Diseases in Fruit and Berry Plantations.]—4th edn., 9¼ × 6 ins., 197 [+1] pp., 23 col. pls., 115 figs. Oslo, Norske Hageselskap; H. Aschehoug & Co. (W. Nygaard), 1956.

This book supplies the need for a concise manual on the common pests and diseases of tree and berry fruits in Norway. The pests comprise both insects and mites, and the information given relates mainly to their bionomics and control. Except for polyphagous species, they are arranged under the plants attacked, and there are final sections on the various methods of control available, with notes on the properties of insecticides and fungicides, and the importance of natural enemies. The coloured plates are a useful addition to the text figures.

European and Mediterranean Plant Protection Organisation. *Hyphantria cunea* **Drury. Report of the Fourth International Conference on Fall Webworm.** [*In English & French.*]—35 pp., 1 pl., refs. Paris, 1957.

A conference on the status of *Hyphantria cunea* (Dru.) in Europe was held in Yugoslavia in September 1956 and was attended by delegates from nine countries, including the Soviet Union. This report by the chairman incorporates three appendices in which the incidence and mechanical and chemical control of the pest in the infested countries and recent investigations in Europe on its bionomics and natural enemies are reviewed. The Arctiid is now present throughout Hungary [*cf. R.A.E.*, A **44** 137], in parts of Austria [*cf.* **40** 376], Czechoslovakia [*cf.* **40** 52], Rumania and Yugoslavia [*cf.* **41** 297], and in the Transcarpathian region of the Ukraine, within the frontiers of the Soviet Union with Czechoslovakia, Hungary and Rumania. It is also stated in a footnote to have been introduced into Japan in 1947 and to have spread rapidly there [*cf.* **41** 356].

In Austria, damage in 1954 was restricted to mulberry, maple and elder. In 1955, these were again preferred, but other fruit trees, particularly apricot, were also attacked, the second generation being unusually injurious. Infestation was light in 1956. In Hungary, infestation was heavy in 1954, and generally heavy in the south and south-east in 1955. Mulberry, maple and plum were the principal food-plants. The moth reached Rumania from Hungary in 1949, and spread rapidly to the south-west, south and east in 1950–53. Mulberry and maple were preferred. Control measures in 1954 and 1955 resulted in eradication from some communes, though it was found for the first time in others in both years. There were normally two generations a year, but a partial third was observed in 1951, 1953 and 1954. In the Ukraine, some 50,000 trees were infested in 1952, when the moth first appeared, but as a result of control measures, only 3,300 were infested in 1955; the attack was much reduced in 1956, as a result of unfavourable weather. Over 42 per cent. of the trees attacked were mulberries. In Yugoslavia, heavy outbreaks occurred in 1954–55, and the pest continued

to spread, particularly in Serbia, where it was approaching the Bulgarian frontier. Severe damage was caused in 1956 by the second generation. Treatment with DDT or BHC has been found to give good control, and the former was in use in all the countries affected.

Parasites of *H. cunea* were obtained from the United States and Canada in 1953–55 and reared in the laboratory in Yugoslavia. The species introduced were the Ichneumonids, *Hyposoter pilosulus* (Prov.), *H. fugitivus* (Say), and *Campoplex validus* Cress., the Braconids, *Rogas hyphantriae* Gah., *Apanteles hyphantriae* Ril., *Meteorus bakeri* Cook & Davis, and *M. hyphantriae* Ril. and the Tachinid, *Mericia ampelus* (Wlk.). *Campoplex* and *Mericia*, which have one generation a year in Canada, had 2–3 and 3, respectively, in the laboratory and would therefore keep pace with *Hyphantria* in the field. The species of *Hyposoter*, *Rogas*, *Apanteles* and *Meteorus* were released in the late summer of 1954 and attacked *Hyphantria*, but were not recovered in the following year, probably because of the absence of secondary hosts. *Mericia* appeared more promising as it overwinters in the soil in the less vulnerable pupal stage. It also attacked silkworms [*Bombyx mori* (L.)] in the laboratory, but the parasite larvae invariably died without causing injury to them. Releases were made in 1956, but the life-cycles of *Mericia* and *Hyphantria* were not well synchronised and it was hoped to import a fresh stock of the parasite from the southern United States, where the climate more closely resembles that of Yugoslavia. Indigenous natural enemies of the moth in Hungary [*cf.* **44** 137], Rumania, and the Soviet Union are briefly discussed. A polyhedral virus disease was isolated from the larvae in Hungary in 1952, and field and laboratory investigations on its propagation gave promising results. Virus-infected larvae were also found in Yugoslavia in 1952, and the disease had become widespread, though latent, throughout the country by 1956.

European and Mediterranean Plant Protection Organisation. **Colorado Beetle in Europe in 1956.** [*In English & French.*]—[3+] 20 + xviii pp., multigraph. Paris, 1957.

The distribution of *Leptinotarsa decemlineata* (Say) on potato in Europe in 1956 is surveyed as for previous years [*cf. R.A.E.*, A **44** 367, etc.]. Owing to unfavourable weather, its incidence was generally light. However, infestation was fairly heavy in Schleswig-Holstein, and eggs, larvae and adults were common in southern Denmark, near the German frontier. Spread to the south continued in Spain, though only slowly, as most of the potatoes in Andalusia are lifted before the population reaches its summer peak. There was some slight extension of the areas affected in eastern Austria and northern and central Italy, and considerable extension in Yugoslavia, particularly in Croatia and Serbia, but the intensity of attack was generally low. Indications were observed in Portugal and Spain of the development of resistance to the chlorinated insecticides regularly applied, but good control was given by arsenicals. There was some regression of infestation in Holland and Luxembourg.

Düzgüneş (Z.). **Armut thripsi** *Taeniothrips inconsequens* **(Uzel).** [The Pear Thrips.]—*Tomurcuk* **4** no. 38 pp. 6–9, 5 figs., 6 refs. Istanbul, 1955.

Little is known of the occurrence of *Taeniothrips inconsequens* (Uzel) in Turkey, but it was observed damaging 10–20 per cent. of pear fruits there in 1951–54. All stages of this thrips are described, and its synonymy, distribution, food-plants, bionomics and control are reviewed, largely from a paper already noticed [*R.A.E.*, A **34** 24].

Keyder (S.). **Türkiyede ilk defa görülen faydalı parazitlerden biri** *Dibrachys cavus* **Walk.** [A useful Parasite, *D. cavus*, observed for the first Time in Turkey.]—*Tomurcuk* **4** no. 38 p. 11. Istanbul, 1955.

In 1952, *Dibrachys cavus* (Wlk.), which had not previously been recorded in Turkey, was found parasitising *Tenebroides mauritanicus* (L.) in stored wheat at Tekirdag.

Hazneci (R.). **Türkiyede kavaklarımızda ilk defa görülen yeni bir zararlı** *Sarrothripus musculana* **Erschoff.** [*S. musculanus*, a new Pest for Turkey, injuring Poplars.]—*Tomurcuk* **5** no. 49 p. 7, 1 fig. Istanbul, 1956. (With a Summary in English.)

Sarrothripus musculanus Ersh. was observed for the first time in Turkey defoliating poplars at Samsun in August 1955.

Ascher (K. R. S.) & Tahori (A. S.). **Resistance of the Spiny Boll Worm to Endrin in Israel.**—*Nature* **179** no. 4554 p. 324, 1 ref. London, 1957.

In 1956, endrin gave poor control of *Earias insulana* (Boisd.) on cotton in the Beith She'an area of Israel, though good results had been obtained in the three previous years and it was still effective in other parts of the country. In a test, larvae were collected from four localities in Beith She'an and adjacent areas and enclosed in petri dishes that had been sprayed, 24 hours previously, to give a deposit of 1 gm. endrin per sq. m. and were kept at 30–31°C. [86–87·8°F.]. Larvae collected from a place in the coastal plain where unirrigated cotton was grown for the first time in 1956, and only one application of endrin had been made, and larvae from untreated *Hibiscus esculentus* were used for comparison. For last-instar larvae, the percentages dead and paralysed from Beith She'an and (in brackets) from the other two sources, respectively, were 10–21 (72 and 86) after 2·5 hours, 17–35 (84 and 98) after five hours, and 38–59 (97 and 100) after 18 hours. There was no mortality in untreated controls.

Venugopal (S.) & Venkataramani (K. S.). **An Agromyzid Insect Pest of "Bhendi".**—*J. Madras Univ.* (B) **24** no. 3 pp. 335–340, 1 pl., 5 figs., 3 refs. Madras, 1954.

The following is based on the authors' summary. Larvae of *Agromyza obtusa* Mall. were found killing young plants of *Hibiscus esculentus* in Madras in 1947 and later caused considerable damage to the developing side-shoots of mature plants in Coimbatore. The maggot bores through the stem tissue, resulting in the wilting and death of the affected plants or branches. All varieties of *H. esculentus* that were examined were susceptible, but a few with a profuse hairy growth on the stem appeared to be comparatively resistant. Spraying once a fortnight with 0·05–0·1 per cent. BHC or DDT gave appreciable control.

Papers noticed by Title only.

Lupo (V.). **Stato attuale della lotta contro la mosca della frutta** (*Ceratitis capitata* **Wied.**). [The present Situation in the Control of *C. capitata* (a review of the literature).]—*Notiz. Mal. Piante* no. 37–38 (N.S. no. 16–17) pp. 149–167, 26 refs. Pavia, 1956.

van Zwaluwenburg (R. H.). **Insects of Micronesia. Vol. 16 no. 1. Coleoptera: Elateridae.**—pp. [3+] 1–66, 12 figs., 1 map. Honolulu, Bishop Mus., 1957. [*Cf. R.A.E.*, A **43** 345; **45** 160.]

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